INSTALLATION RESTORATION PROGRAM

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Site Investigation Report

AD-A251 715

Final

GEORGIA AIR NATIONAL GUARD
SAVANNAH, GEORGIA

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January 1992

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A Site Investigation was conducted at the Georgia Air National Guard Base in Savannah, Georgia to determine the presence or absence of contamination at nine potential sites. Five sites were recommended for immediate soil removal. Site No 6 was recommended for no further action. A remedial investigation was recommended for the majority of sites. Contamination was found in soils, sediments, groundwater, and surface water. Contaminants detected were BTEX and TCE.

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AIR NATIONAL GUARD
INSTALLATION RESTORATION PROGRAM
SITE INVESTIGATION REPORT

165TH TACTICAL AIRLIFT GROUP
AND
THE COMBAT READINESS TRAINING CENTER
GEORGIA AIR NATIONAL GUARD
SAVANNAH INTERNATIONAL AIRPORT
SAVANNAH, GEORGIA

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MARTIN MARIETTA ENERGY SYSTEMS, INC.

For the

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CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

Page

TABLES

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

ACRONYMS AND ABBREVIATIONS

ANGRC	Air National Guard Readiness Center
ARAR	Applicable or Relevant and Appropriate Requirements
ATDSR	Agency for Toxic Substances and Disease Registry
AVGAS	Aviation Gasoline
bls	below land surface
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEVR	Installation Restoration Program Branch, Environmental Division
CRTC	Combat Readiness Training Center
DD	Decision Document
EPA	United States Environmental Protection Agency
FCRF	Field Change Request Form
FFS	focused feasibility study
fpd	feet per day
FS	feasibility study
FAWQC	Federal Ambient Water Quality Criteria
GAEPD	Georgia Environmental Protection Division
GANGB	Georgia Air National Guard Base
gpm	gallons per minute
HAZWRAP	Hazardous Waste Remediation Action Program
HMTC	Hazardous Materials Technical Center
hNu	photoionization detector
ICV	initial calibration verification
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg-day	milligram per kilogram of body weight per day
mg/l	milligrams per liter
NCP	National Contingency Plan
NGB	National Guard Bureau
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
PAH	polynuclear aromatic hydrocarbon
PFTS	Permanent Field Training Site
PID	Photoionization Detector
POL	petroleum, oil, and lubricants
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RM	remedial measures

Acronyms and Abbreviations (continued)

SDWA	Safe Drinking Water Act
SI	site investigation
SOV	soil organic vapor
TBC	to be considered
TCE	trichloroethylene
TDS	total dissolved solids
TOC	total organic carbon
TOH	total organic halogens
TPH	total petroleum hydrocarbon
UST	underground storage tank
VOC	volatile organic compound
% RSD	percent relative standard deviation
%D	percent difference

EXECUTIVE SUMMARY

The Installation Restoration Program (IRP) at the Georgia Air National Guard facility in Savannah, Georgia has been active since 1986. During this period a Preliminary Assessment was prepared by Hazardous Materials Technical Center (HMTC) and submitted in 1987. CH2M HILL was introduced to the project in a "Kick-off" meeting which was conducted at the Base in March 1989. Following the initial meeting, a Project Management Plan (PMP) and Sampling and Analysis Plan (SAP) were submitted to the Installation Restoration Program Branch (CEVR), Environmental Division of the Air National Guard Readiness Center. The PMP and SAP were submitted in December 1989 and March 1990 respectively.

A two-step Site Investigation (SI) was conducted to evaluate the presence of environmental contamination that may have resulted from past activities at nine discharge/spill sites at the 165th Tactical Airlift Group (TAG) and the Combat Readiness Training Center (CRTC), Georgia Air National Guard Base (GANGB) in Savannah, Georgia. The sites included in the SI are listed below:

Site No.	Description
1	CRTC Hangar and Washrack Discharge Point
2	CRTC Vehicle Maintenance Washrack Discharge Point
5	165th Bulk Fuel Facility
6	165th Vehicle Maintenance Spill Area
7	165th Vehicle Maintenance Washrack
8	Old 165th Aircraft Washrack
9	165th Current Fire Training Area
10	Bulk Chemical Storage Area
11	Old Burn Area

The first step of the SI involved a preliminary field screening, which included collecting split-spoon and hand-augered soil samples, installing piezometers, and performing a soil organic vapor (SOV) survey on in situ soils using a portable gas chromatograph. Split-spoon and hand-augered soil samples were also field screened with the gas chromatograph. Phase I of the field investigation was performed between May 7 and July 14, 1990. If the gas chromatograph detected contamination in a soil sample, the sample was sent to the laboratory for analytical testing. The data collected were analyzed and reviewed to evaluate the need for and direction of further SI activities.

In the SOV survey, volatile organic compounds (VOCs) were detected above the confidence threshold of the gas chromatograph at Site No. 5, Site No. 7, Site No. 8, Site No. 9, Site No. 10, and Site No. 11. The split-spoon and hand-augered soil samples collected at Site No. 2, Site No. 5, Site No. 7, Site No. 8, Site No. 9, Site No. 10, and Site No. 11 showed organic contaminants including VOCs, polynuclear aromatic hydrocarbon (PAH) compounds, and total petroleum hydrocarbon (TPH).

The second step of the SI included the installation of monitor wells, collection of groundwater, surface water, and sediment samples for laboratory analyses, and aquifer testing to describe groundwater flow direction and hydraulic conductivity. This phase of the investigation was performed between August 27 and October 5, 1990.

At Site No. 1, contamination was not detected in groundwater samples from the two newly installed monitor wells or in surface water samples. Low levels of toluene was detected in one soil sample. Analytical results of the sediment samples detected PAH compounds in certain areas of the drainage ditch leading from the point of discharge and nearby roadways. Based on the results of this SI, a decision document proposing no further action will be pursued for groundwater, soil, and surface water at Site No. 1. A decision regarding sediments will be made following additional SI work to collect background and upgradient sediments.

The laboratory analyses of the groundwater and surface water samples collected at Site No. 2 detected low levels of TPH, ranging from 0.8 to 3.83 mg/l. Analytical results of sediments underlying the drainage ditch showed elevated levels of PAH compounds and TPH. Although it appears that the concentrations decreased with distance from the point of discharge, an uncontaminated sample was not identified. The contamination may have been caused by an oil-water separator discharging to the ditch. Surface soil samples also contained PAH and TPH; however, vertical migration was not observed. Based on these results, a decision document will be pursued for groundwater. Confirmatory sampling will be conducted for sediments and surface water. Soil will be removed in affected areas following additional SI work to estimate the volume.

Analyses of groundwater samples from newly installed wells Site No. 5 detected only trace quantities of TPH. However, analyses of a sample collected from an existing well near a buried heating-oil tank detected VOCs and PAH compounds in particular, benzene above the MCL. Organic contamination was also detected in the surface soil samples. This contamination may extend offsite. Based on these results, a removal action will be pursued for soil. An RI will be conducted for groundwater and include offsite monitor wells in areas where spilled fuel was collected.

One monitor well was installed at Site No. 6 during the second step of the SI, and the sample collected from this well contained 0.09 mg/l TPH, which is slightly above detection levels. Other compounds in this sample were below detection levels. No soil contamination was detected. Based on these results, a decision document will be pursued for this site.

Analyses of a groundwater sample collected at Site No. 7 detected low levels of VOCs and PAH compounds below MCLs. Surface water contamination was not detected at this site; however, there was no flow from the oil-water separator effluent pipe at the time of sampling. Analyses of sediment samples collected from the onsite ditch detected TPH concentrations ranging from 3.4 to 658 mg/kg, with concentrations decreasing with distance downstream of the discharge point of the oil-water separator. Soil boring samples in the vicinity of the washrack had to be abandoned because of observed contamination. A removal action will be pursued for soil at Site No. 7. Confirmatory sampling will be conducted for groundwater, surface water, and sediments.

Of the samples collected from the three monitor wells installed at Site No. 8, only one sample contained TCE (69,000 μg/l) above detection limits. The MCL for TCE is 5 μg/l. Analyses of surface water samples detected TCE at 4.4 μg/l. Elevated levels of VOCs and PAH compounds were detected in the sediment samples collected. Based on these results, an RI will be conducted for groundwater, surface water, soil, and sediments.

Of the groundwater samples collected from the four monitor wells installed at Site No. 9, all of the samples except the one from the background well contained VOC, PAH, and TPH contamination. Benzene was detected in excess of MCLs. This contamination may be the result of leaks from the oil-water separator or breaches in the liner underlying the burn area. Contamination was not detected in the surface water samples from the pond adjacent to the Fire Training Area or in the sample from the effluent ditch leading from the oil-water separator. This condition could change based on the frequency of use of the Fire Training Area. Analyses of a sediment sample collected from the effluent ditch leading from the oil-water separator detected 67.9 mg/kg TPH. Contamination was observed in soils near the oil-water separator. Based on these results, the soil will be removed and disposed. An RI will be conducted for groundwater, surface water, and sediments.

At Site No. 10, laboratory analyses detected VOC contamination in a groundwater sample collected from a monitor well installed downgradient from the Bulk Chemical Storage Area. The source of contamination for this site may have been leaks in the storage drums that were previously located there. Soils in the storage area were contaminated. An RI will be conducted for soils and groundwater.

Of the samples collected from one existing monitor well and three newly installed wells at Site No. 11, only the sample from the well located along the perimeter just downgradient of the Old Burn Area contained elevated levels of VOCs and PAH compounds. Benzene was in excess of MCLs. The samples from the other downgradient wells did not contain contamination above detection limits. Contamination was detected in soils. Based on these results, the contaminated soil will be removed. Groundwater will be resampled to confirm the absence of downgradient migration of contamination.

Section 1
INTRODUCTION

Martin Marietta Energy Systems is assisting the Installation Restoration Program Branch (CEVR), Environmental Division of the Air National Guard Readiness Center (ANGRC) in identification and remediation of environmental contamination through the Installation Restoration Program (IRP). CH2M HILL has been assigned under General Order 18B-97777C, Task Order Authorization No. Y-01, to investigate nine discharge/spill sites at the Georgia Air National Guard Base (GANGB) in Savannah, Georgia.

1.1 ORGANIZATION OF THIS REPORT

This Site Investigation (SI) Report contains seven sections that summarize and evaluate the SI activities and data. This introductory section describes the scope of work, the background of the project, the sites involved in the SI, the environmental setting of the sites, and the Applicable or Relevant and Appropriate Requirements (ARARs) that apply to the sites. Section 2 outlines the field program and describes the types of samples collected, the methods used to obtain the samples, and the locations from which the samples were collected. Section 3 summarizes the results of the SI field and laboratory activities, and Section 4 summarizes the data validation report. Section 5 presents the preliminary risk evaluation, and Section 6 summarizes the conclusions and recommendations for each of the nine sites. References used in the preparation of this SI Report are listed in Section 7.

1.2 SCOPE

The SI was conducted in two steps to collect data that would support an evaluation of the nature and extent of contamination of groundwater, soil, surface water, and sediments at the nine discharge/spill sites at GANGB. The primary purpose of the field screening step was to obtain a preliminary indication of the nature and extent of contamination at each site. The second step of the SI focused on confirmatory sampling to collect more detailed data on the contamination at the sites identified in the first step as requiring further information. Except as noted in this report, SI work was performed in accordance with the *Site Investigation Sampling and Analysis Plan* prepared by CH2M HILL in March 1990.

The first step of the SI, the field screening phase, was conducted from May 13 through July 13, 1990, and consisted of soil organic vapor (SOV) analyses, soil sampling, and a preliminary hydrogeologic assessment. Field activities for the second step of the SI, the confirmatory sampling phase, were conducted from August 27 through October 3, 1990, and included installation and development of monitor wells;

sampling of groundwater, surface water, and sediment; and aquifer testing. The sampling locations and parameters analyzed in the second step of the SI were based on the results of the first step. Laboratory analysis was concluded in November 1990. Data validation of these analyses were conducted from December 1990 through February 1991.

The results of the SI were used to make recommendations for the appropriate actions for individual or combined sites, or for an operable unit (e.g., soils). The recommendations are one of the following: develop a decision document stating that no further action is required, perform a focused feasibility study (FFS) that will evaluate remedial alternatives, perform additional SI activities, or perform a remedial investigation (RI) that will further evaluate the extent and type of contamination.

1.3 BACKGROUND

In 1987, the Hazardous Materials Technical Center (HMTC) conducted a preliminary assessment at GANGB to identify potentially contaminated sites. Assessment tasks included an onsite visit, interviews with past and present employees, a review of hazardous material generation and disposal records, and research and review of geologic and environmental conditions. The initial results of the assessment identified nine sites potentially contaminated by hazardous waste or fuel. After identifying the nine sites, a hazardous assessment matrix was developed. The matrix weighed such factors as potential contamination receptors, waste characteristics, transport pathways, and waste management practices. As a result of the preliminary assessment, it was recommended that Site No. 3 (Old Plywood Factory) and Site No. 4 (Old Landfill Area) be excluded from further investigation. Decision documents were written for these sites and approved by the Georgia Environmental Protection Division (GAEPD) of the Georgia Department of Natural Resources. These sites, therefore, were not included in the SI.

On March 15-16, 1989, an initial coordination meeting was held at GANGB. The purpose of the meeting was to outline the objectives of the IRP program and develop SI activities. This meeting was attended by representatives of GANGB, ANGRC/CEVR Martin Marietta Energy Systems, and CH2M HILL. Each of the seven sites to be studied were visited on March 15, 1989.

On March 16, 1989, GANGB personnel indicated the existence of a potentially contaminated site located at the Bulk Chemical Storage Area. Chemical releases were thought to have occurred there during the dispensing of chemicals from drums. Discolored soil near the chemical storage area was observed during the site visit. In April 1989, Martin Marietta Energy Systems authorized CH2M HILL to add Bulk Chemical Storage Area (Site No. 10) and a ninth site, the Old Burn Area (Site No. 11) to the list of sites under investigation.

1.4 FACILITY DESCRIPTION

GANGB has been active since the end of World War II. It is staffed by personnel from the 165th Tactical Airlift Group (TAG) and the Combat Readiness Training Center (CRTC) (formerly the Permanent Field Training Site [PFTS]). The 165th TAG provides tactical airlift support, and the CRTC maintains training facilities for Air National Guard (ANG) and Air Force Reserve units. Approximately 180 buildings are constructed on GANGB's 233 acres. GANGB is next to the eastern edge of Savannah International Airport, approximately 8 miles northwest from the City of Savannah (Figure 1-1).

The region in which GANGB is located is characterized by high annual precipitation (approximately 50 inches per year). The water table is located at a depth of about 2-10 feet below land surface (bls) except in areas built up with fill materials. The major source of local drinking water, the Floridan aquifer, lies about 300 feet bls. A majority of the soils are moderately to highly permeable.

1.5 SITE HISTORY

The following nine discharge/spill sites were included in the SI:

Site No.	Description
1	CRTC Hangar and Washrack Discharge Point
2	CRTC Vehicle Maintenance Washrack Discharge Point
5	165th Bulk Fuel Facility
6	165th Vehicle Maintenance Spill Area
7	165th Vehicle Maintenance Washrack
8	Old 165th Aircraft Washrack
9	Current Fire Training Area
10	Bulk Chemical Storage Area
11	Old Burn Area

Figure 1-2 shows the locations of these nine sites. Past activities that may have led to environmental contamination are briefly described below.

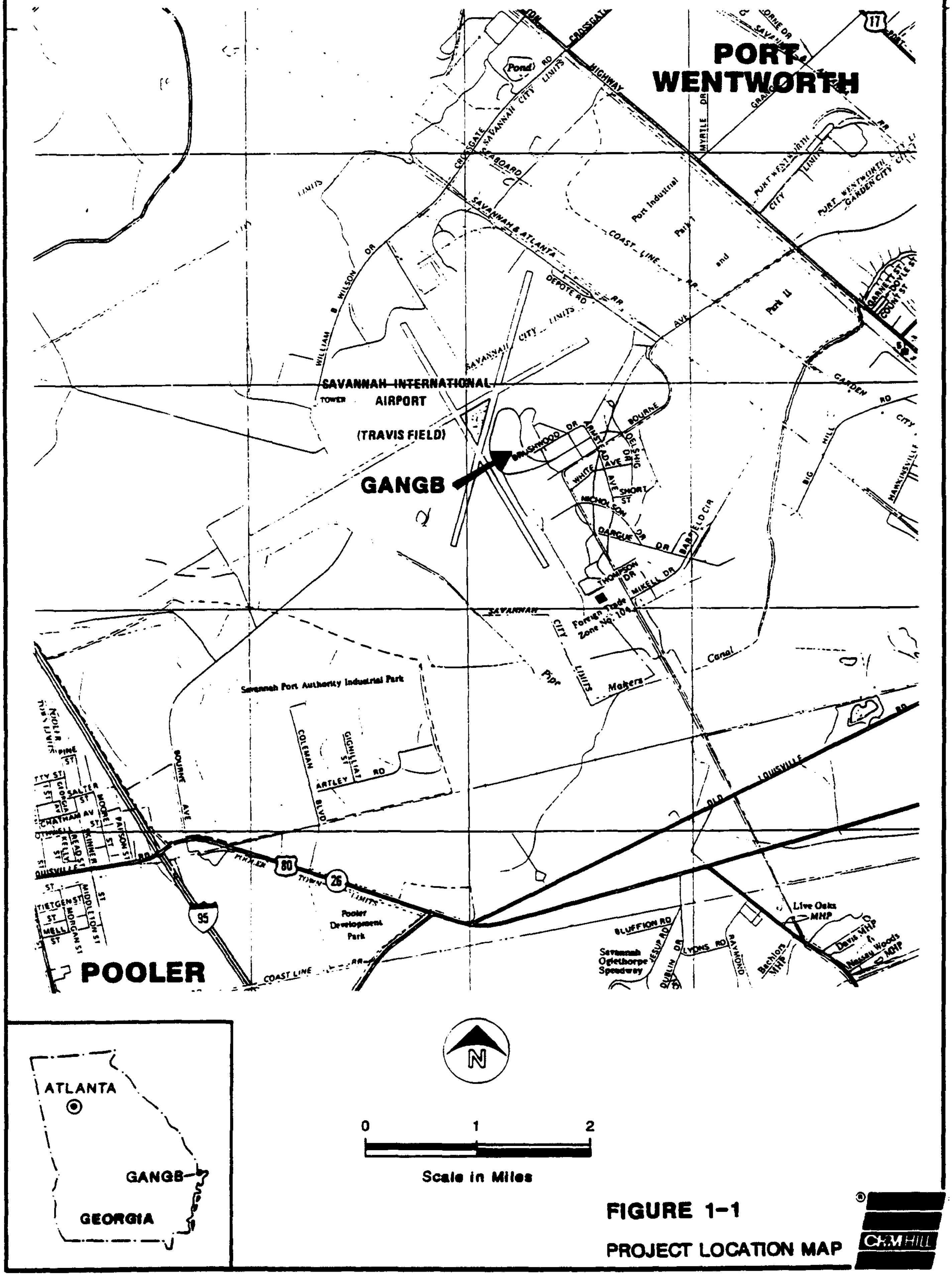

FIGURE 1-1

PROJECT LOCATION MAP

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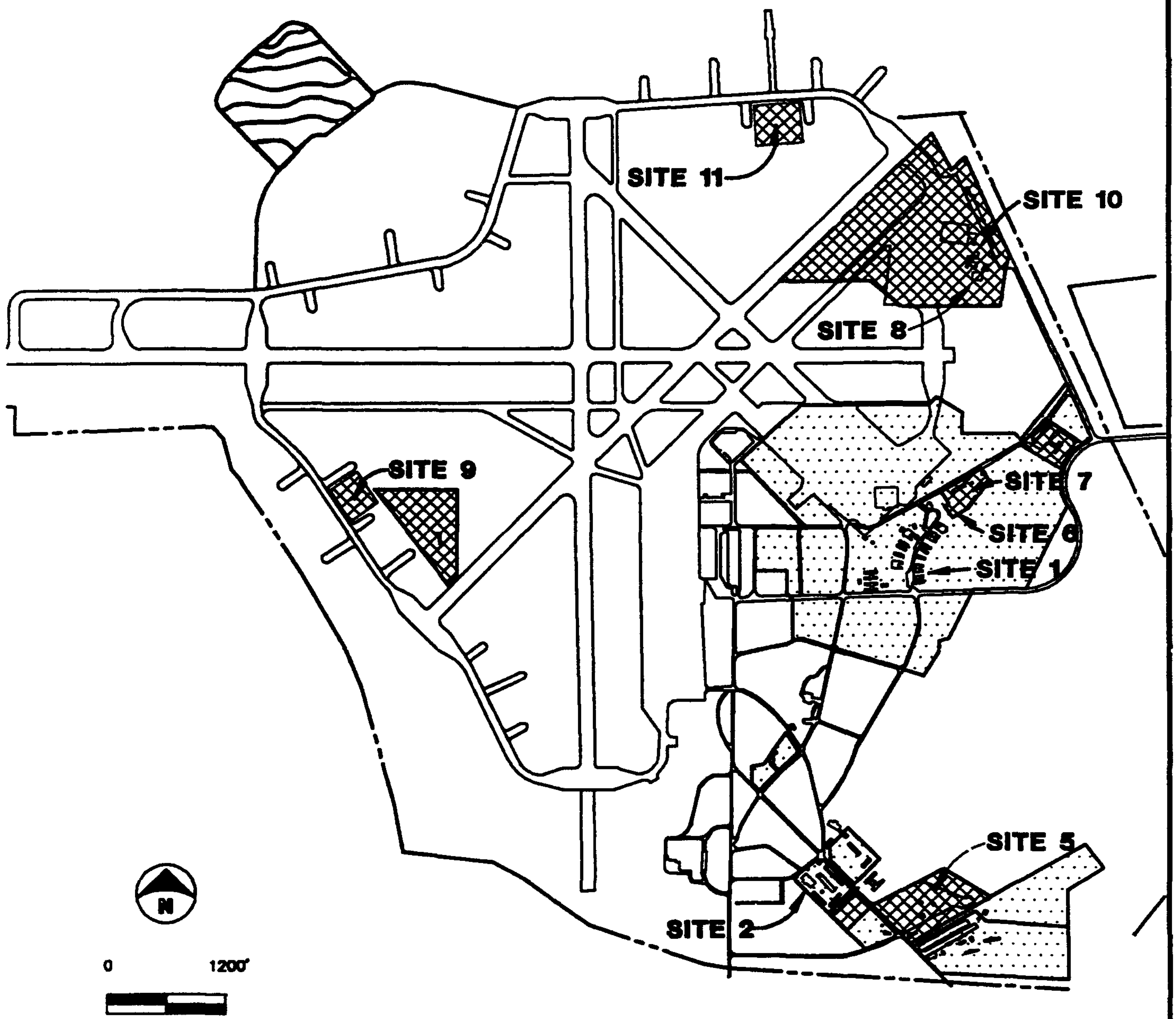

165th TACTICAL AIR GROUP PROPERTY BOUNDARIES

COMBAT READINESS TRAINING CENTER (CRTC) PROPERTY BOUNDARIES

FIGURE 1-2

SITE LOCATION MAP
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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1.5.1 SITE NO. 1--CRTC HANGAR AND WASHRACK DISCHARGE POINT

Site No. 1 is northeast of Building 199 and consists of a concrete pavement that drains into a central stormwater intake structure. The stormwater sewer line connects into a drainage system that collects floor drainage from Building 199 and from several exterior stormwater culverts. The stormwater line travels southeast under personnel-housing facilities and discharges into an open drainage ditch approximately 200 yards from the washrack. The ditch traverses an open field in an eastward direction and crosses the base boundary. This ditch empties into the Pipemakers Canal and a retainage pond next to GANGB at the Days Inn Motel. The approximate total length of the ditch and canal is 1,100 feet.

The CRTC washrack was reportedly used from 1946 to 1966. During this period, the facility was used for aircraft washing and painting. These procedures generated waste paints, strippers, and solvents which ran off the pavement and into the storm sewer which eventually discharged into a surface ditch. During the course of its use, GANG personnel estimate that approximately 40,000 gallons of waste products were discharged into the storm drains.

During the March 1989 site visit, a plume of white liquid was observed entering the ditch at the discharge point. The plume moved downgradient and was diluted as it flowed through the drainage ditch. The origin of the liquid was traced to an area on the southwest side of Building 199 that is used for washing visiting aircraft. The composition of the white liquid was unknown; however, GANGB personnel indicated that PD-680 (stoddard solvent) has been and is still being used at the washrack facility. PD-680 is composed primarily of mineral spirits. The approximate composition of PD-680 is linear and branched alkanes (30 to 50 percent), cycloalkanes (30 to 40 percent), aromatics (10 to 20 percent), benzene (trace), and olefins (trace) (*USAF Installation Restoration Program Toxicity Guide*). Drums of PD-680 were found in a drum-storage facility south of Building 199.

1.5.2 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

The CRTC Vehicle Maintenance Washrack is in the southwest section of the CRTC Vehicle Maintenance Facility. The washrack is used to wash vehicles and engines. Runoff from these activities is collected in a central stormwater intake grating, which, until 1980, drained directly into an adjacent ditch. In 1980, the drainage system was rerouted through an oil/water separator, which subsequently drains into the ditch. Washing activities, including the use and discharge of PD-680, are reportedly still occurring at this site.

During the course of its use (early 1950's to present), it is estimated that 10,000 gallons of mineral spirits, varsol, and PD-680 were discharged into the drainage ditch.

1.5.3 SITE NO. 5--165th BULK FUEL FACILITY

The Bulk Fuel Facility, also called the petroleum, oil, and lubricants (POL) facility, contains bulk storage for fuels and lubricants used at GANGB. The site contains two aboveground storage tanks, which are within asphalt berms. A 10,000-gallon underground storage tank is at the northeast corner of the bulk fuel facility. The tank reportedly contains heating oil. Two shallow monitor wells are next to the tank. Approximately 2 years ago, buried piping was abandoned in place and replaced with aboveground and buried-in-vault piping. The POL facility has been used continuously since the early 1940's. During this period, JP-4 and AVGAS aviation fuels have been stored in bulk quantity. Minor spillage, associated with piping failures have been reported periodically during the POL's history. Additionally, it has been reported that sludge and draw water removed from the storage tanks has been discharged on the ground surface to consolidate.

A 4,600-gallon spill of JP-4 or AVGAS fuel was also reported to have occurred at the Bulk Fuel Facility. The spill occurred at the northeast corner of the facility and moved east-northeast. The fuel reportedly accumulated in a low-lying wooded area just outside of the bulk fuel facility and beyond the base boundary. GANGB personnel report that approximately 3,000 gallons of the spilled fuel was recovered.

1.5.4 SITE NO. 6--165th VEHICLE MAINTENANCE SPILL AREA

In the early 1960s, a spill of approximately 2,500 gallons of JP-4 or AVGAS fuel occurred at the southeast corner of the 165th Vehicle Maintenance Building. The fuel moved east and south of the paved area into the wooded area behind the facility. GANGB personnel reported that about half of the spilled fuel was recovered.

1.5.5 SITE NO. 7--165th VEHICLE MAINTENANCE WASHRACK

Site No. 7 is the former location of a motor-vehicle washrack (vehicle-washing activities are now performed at Site No. 2). The washrack was at the northwest corner of the vehicle maintenance facility within Building 1412 and was operated between the early 1950's to the mid-1980's. During facility operation, used solvents and detergents were collected in a floor drain and discharged into a drainage ditch located approximately 150 feet northeast of the site. An oil-water separator was installed between the floor drain and the discharge point in 1980 to prevent floating hydrocarbons from entering the drainage ditch. During its 30 years of operation, it is estimated that approximately 10,000 gallons of PD-680 were discharged into the drainage ditch.

In addition to the floor drain discharge, a one-time spill of approximately 300 gallons of JP-4 was reported at Site No. 7. The date of the spill is unknown, however, personnel accounts of the incident indicate that the spill was unrecovered and soaked into the groundsurface.

1.5.6 SITE NO. 8--OLD 165th AIRCRAFT WASHRACK

This aircraft washrack is at the eastern boundary of the airport near Building 1914 and was used from 1961 to 1983. The facility was used for aircraft degreasing and painting. Detergents, paints, PD-680, trichloroethylene, and trichloroethane were used at this site at an estimated rate of 40 gallons per month (11,000 estimated total discharge). Spent solvents were collected through storm drains and discharged directly into an adjacent drainage ditch. Because low lying area surround the washrack/apron area, discharge runoff is a secondary pathway of concern. Although degreasing and painting operations were discontinued at Site No. 8 in 1983, discharges of paints and solvents have been recently observed.

1.5.7 SITE NO. 9--CURRENT FIRE TRAINING AREA

The Fire Training Area is on the west side of the Savannah International Airport. It is maintained and used by GANGB to train emergency personnel in fire-fighting techniques. The area is approximately 130 feet-by-130 feet and is underlain by a thin plastic liner. The liner collects unburned fuel and channels it into an oil/water separator located about 100 feet northwest of the Fire Training Area. The oil/water separator then drains into an adjacent canal.

The Fire Training Area was used from 1980 to 1990. During training activities, approximately 500 to 1000 gallons of JP-4 was ignited and extinguished. It is estimated that during the course of its use, up to 120,000 gallons of JP-4 may have been used with the majority of this volume being consumed by flame. It has been reported that only water was used to extinguish training fires; however, chemical fire extinguishing agents may have been used at this site.

1.5.8 SITE NO. 10--BULK CHEMICAL STORAGE AREA

The bulk chemical storage area is an unpaved area approximately 25 feet-by 35-feet, adjacent to Building 1910. The facility has been reportedly used for 12 to 15 years (1975 to 1990) for storing chemicals such as oil, PD-680, B&B 20/20, methyl ethyl ketone, and trichloroethylene. At the time of the site visit, six drums were onsite. The drums were later moved to a paved area behind Building 1910.

1.5.9 SITE NO. 11--OLD BURN AREA

The old burn area is near the northern GANGB boundary on the access road next to the Composite Building. This area was used as a GANGB fire-fighting training area from 1940 until the property was sold to Gulfstream Aerospace Corporation (1980). The Old Burn Area was used for waste disposal as well as for fire training exercises. Fuels and waste chemicals and equipment were burned at this site. Unlike Site No. 9, the old burn area contained no impermeable liner or berm.

A preliminary assessment of the facility prepared by Gulfstream included the installation and sampling of two groundwater monitor wells. Analyses of the groundwater samples indicated elevated concentrations of total organic carbon (TOC), total organic halogens (TOHs), lead, sulfate, and phenols. The lateral extent of the contamination has not been determined.

1.6 ENVIRONMENTAL SETTING

GANGB is in the northeast coastal region of Georgia, approximately 8 miles northwest of the City of Savannah. The base, which next to the eastern edge of Savannah International Airport, occupies approximately 233 acres on nine separate parcels leased from the Savannah Airport Commission.

Property north and northwest of the airport is predominantly undeveloped, although a substantial amount of this land is used for agricultural and commercial forestry. Wetlands also occupy some of the area to the north-northwest of the airport. Commercial and limited residential developments occupy some of the land to the south. To the east and southeast, the Seaboard Coast and Central of Georgia Rail Roads occupy the majority of the land. The Savannah River is 2.5 miles east of the airport. West of the airport are the Cities of Pooler and Bloomingdale, an industrial park, large farms, low-density mobile home parks, and wetlands (Woblpert Consultants, 1990).

1.6.1 METEOROLOGY

The climate of the Savannah area is characterized by mild temperatures and abundant rainfall. Winters are usually short and mild with occasional cold periods of short duration. Summers are long and hot and typically very wet. Average annual precipitation is approximately 50 inches, with nearly half of this value recorded between June and September.

1.6.2 GEOLOGY

Savannah International Airport is in the Coastal Plain province, approximately 18 miles west of the Atlantic Ocean. The Coastal Plain geology consists of a seaward-thickening accumulation of sediments overlying igneous and metamorphic bedrock.

The surficial sediments at GANGB consist predominantly of sands of the Pliocene to Recent age, remnants of ancient barrier islands and lagoons. These unconsolidated sediments extend from land surface to a depth of approximately 40 to 80 feet bls (Herrick, 1961; Counts and Donsky, 1963). Throughout the base, the thickness of the overlying sediments has been documented to vary locally. Much of the base, however, has been backfilled with unidentifiable borrow material.

Underlying the surficial sands is the Hawthorn Formation. This formation is a layer of clay and sandy-clay of the Miocene age and is reported to range in thickness from 125 to 178 feet, with an estimated depth up to 300 feet bls (Counts and Donsky, 1963). Because of the relatively low permeability of this formation, the Hawthorn clays serve as a confining or semi-confining unit between the surficial and Floridan aquifers. Below the Hawthorn clays are several hundred feet of limestones, including the Tampa and Ocala Formations. These units are highly permeable and compose the Floridan aquifer, the primary source of potable water in the area. Figure 1-3 illustrates a general lithologic profile of coastal Georgia in the vicinity of GANG.

1.6.3 SOILS

The soils at GANGB have been mapped by the U.S. Soil Conservation Service and have been identified to consist primarily of Chipley-Urban land complex soils. This complex is 40 to 70 percent Chipley fine sandy soil and 20 to 40 percent Urban land, which is land so altered by construction or obscured by structures that identification of the soil is difficult or impossible. The Chipley soils range in color from dark grayish-brown near the surface to yellowish-brown at depth. The soils are free-draining and have a high rate of permeability (4.4×10^{-3} cm/s to 7.1×10^{-3} cm/s). Small areas near the perimeter of GANGB are composed of Ogeechee-Urban land complex soils. This material is composed of 40 to 60 percent loamy fine sandy soil and 30 to 40 percent Urban land. This material is somewhat poorly drained and may be found in the low-lying wetlands. The Ogeechee-Urban land complex soils may be finer grained and have a lower permeability (4.4×10^{-4} cm/s to 1.4×10^{-3} cm/s) than the Chipley-Urban land complex soils.

1.6.4 HYDROLOGY

Savannah International Airport is within the Savannah River drainage basin. All surface drainage from the airport is collected by a series of canals and ditches, which outfall into the Pipemakers Canal and ultimately discharge into the Savannah River. Figure 1-4 illustrates surface water drainage patterns for the eastern portion of the base.

The surficial or water table aquifer occupies the surficial sediments of the Coastal Plain region. The aquifer is unconfined and underlain by clays of the Hawthorn Formation. Groundwater in the surficial aquifer occurs at a depth of 2 to 10 feet bls. Although this aquifer is not currently being used for public water supply, it is reported that some residents within a mile of the airport may derive drinking water from wells completed into the surficial aquifer.

Groundwater generally flows from topographically high to low areas. At the Savannah International Airport, a topographic high exists at the intersection of two closed runways, just north of Runway 27. From this high point, groundwater flows radially toward lower elevations. As a result, groundwater east of the high will flow east, west of the high will flow west, north of the high will flow north, and south of

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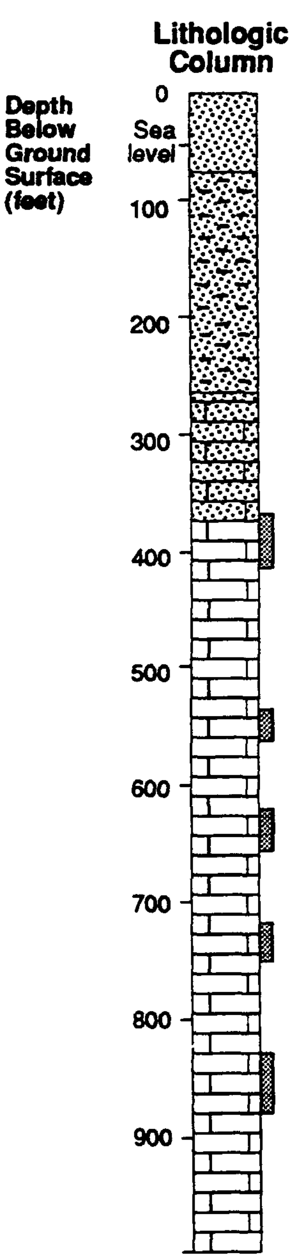
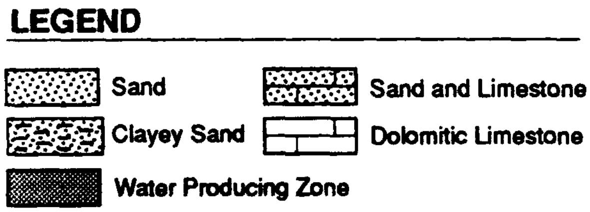


Formation Name	Geologic Age	Hydro-Geologic Framework
Undiffentiated Sands and Clay	Pliocene Recent	Surficial Aquifer
Hawthorne Formation	Miocene	Upper Confining Unit
Undifferentiated Sand and Limestone	Oligocene	Floridan Aquifer
Ocala Limestone Formation	Upper Eocene	
Lisbon Limestone Formation	Middle Eocene	



* *From Herrick (1961) and Krause, et al., (1983) at well CHA 452, Port Wentworth, Georgia*

FIGURE 1-3
Generalized Lithologic Profile
Georgia Air National Guard
Savannah, GA

CH2M

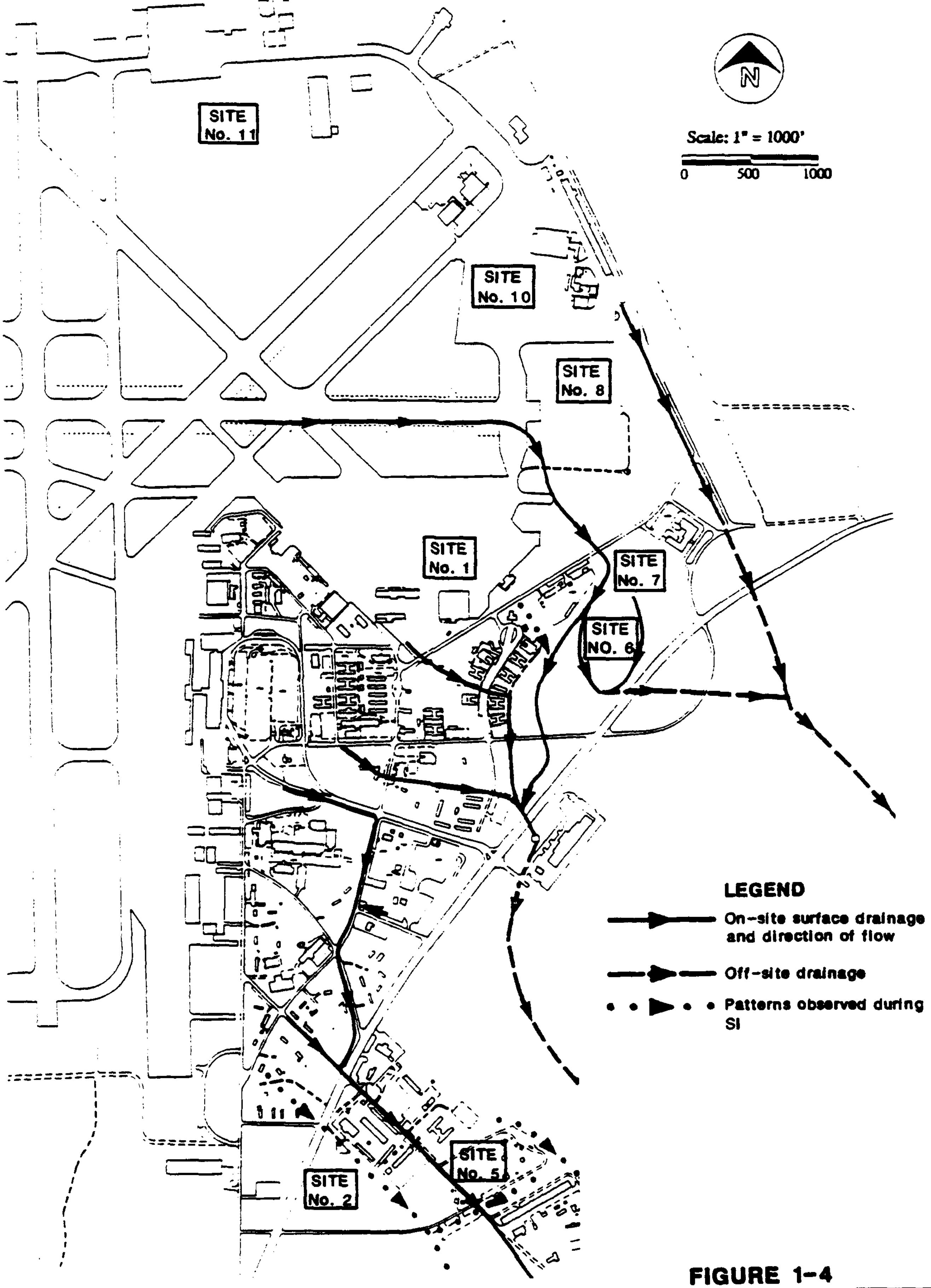


FIGURE 1-4

SURFACE DRAINAGE PATTERNS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

the high will flow south (Figure 3-19 illustrates groundwater flow patterns projected using actual field data collected during the SI [10-03-90]).

Underlying the Hawthorn Formation is the Floridan aquifer. Water in this aquifer is under artesian pressure and serves as the primary source of public water supply. The Floridan aquifer is highly permeable and could serve as a potential conduit for contamination. However, because of the significant confining or semi-confining unit and artesian pressures in this aquifer, contamination of the aquifer from surface sources is unlikely.

1.7 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d)(2)(A) of the Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA) specifies that remedial actions under CERCLA must meet federal standards, requirements, criteria, or limitations that are legally ARARs for the action. This concept is also used for the Department of Defense IRP, which governs the SI for GANGB.

Remedial alternatives must be selected that, among other criteria, attain or exceed the designated ARARs. If a state requirement is more stringent than a federal requirement, the state requirement becomes the ARAR. Local regulations and ordinances are not ARARs, but may be considered when useful or necessary to protect human health and the environment.

ARARs may be waived if one of the following circumstances exists:

- The remedial action selected is one part of a total remediation, and the final remedial activities will attain the ARAR.
- Compliance with the ARAR will result in a greater risk to human health and the environment.
- Compliance with the ARAR is technically impracticable.
- An alternate remedial action will attain the same performance.
- The ARAR is a state requirement that has not been applied consistently.
- Compliance will not provide a balance between environmental protection and availability of funds.

CERCLA Section 121(e) exempts any response action being conducted entirely onsite from needing a federal, state, or local permit if the action is carried out in compliance

with Section 121. In general, onsite actions need to comply only with the substantive aspects of federal and state ARARs.

A requirement is applicable if the specific terms of the law or regulation directly address the circumstances at a site. If not applicable, a requirement may nevertheless be relevant and appropriate if circumstances at the site are sufficiently similar to the problems or situations regulated by the requirement.

Those standards that are not ARARs may be viewed as "to-be-considered" (TBC) guidelines. Nonpromulgated advisories or guidance issued by federal or state government may also be considered TBC guidelines.

When state ARARs are more stringent than federal requirements, the state requirements need to be considered as potential ARARs. In order to qualify as a state ARAR, a state requirement should be:

- A state law
- An environmental facility law or siting
- Promulgated
- More stringent than federal requirements
- Identified in a timely manner
- Consistently applied

ARARs are generally classified as: (1) location-specific, (2) chemical-specific, or (3) performance-, design-, or action-specific (action-specific). The three classifications of ARARs are defined below:

- Location-specific ARARs are restrictions placed on activities or the concentration of hazardous substances solely because they occur in special locations.

- Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies, which, when applied to site-specific conditions, result in the establishment of numerical values. These values reflect the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.

- Action-specific ARARs are usually technology- or activity-based or are limitations on actions to be taken with respect to hazardous wastes.

The location-specific ARARs generally can be established early in the SI, RI, or feasibility study (FS) process because these criteria are not established by the type of contaminant or the type of remedial action implemented. The chemical-specific ARARs can be established once the nature of the contamination at the site has been assessed, which is accomplished sometime during the SI or RI. The action-specific

ARARs cannot be established until the specific remedial technologies that may be employed at the facility are identified.

Since the SI at GANGB has been completed, location-specific and chemical-specific ARARs have been identified. Because a screening of alternatives has not been conducted yet, action-specific ARARs will be identified at a later date.

1.7.1 LOCATION-SPECIFIC ARARS

Location-specific ARARs identify requirements that must be addressed by remedial alternatives. Table 1-1 shows location-specific ARARs. The primary location-specific issues at GANGB relate to the flood plain and wetlands. Portions of Site No. 5 are within the 100-year floodplain and the drainage ditch at Site No. 7 flows near a wetland area.

1.7.2 CHEMICAL-SPECIFIC ARARS

The potential chemical-specific ARARs and TBC guidelines for GANGB are presented in the following sections. The standards contained in these tables include Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs), SDWA MCL Goals (MCLGs), and water quality criteria.

In developing remediation goals, chemical-specific ARARs are identified in the National Contingency Plan (NCP) as one of the factors to be considered. The other factors that are considered are risk-based numbers for systemic toxicants and carcinogens.

1.7.2.1 Maximum Contaminant Levels

Compliance with MCLs is dictated in CERCLA, RCRA, and SDWA regulations. Regarding CERCLA and SDWA regulations, the U.S. Environmental Protection Agency (EPA) notes in the NCP (55 FR 8750) that "since MCLs are legally applicable under the SDWA to the quality of drinking water at the tap, there will be few instances in which MCLs are applicable to cleanup of groundwater at a Superfund site. For this reason, MCLs are generally considered relevant and appropriate to groundwater that is or may be used for drinking."

Shallow groundwater in the vicinity of GANGB is not a current source of drinking water for public water utilities. However, there are indications that some residents within a mile of the airport use the shallow aquifer for drinking water. In addition, GAEPD has indicated that they consider the shallow aquifer as a potential drinking water source. Therefore, at GANGB, MCLs will be considered ARARs.

Table 1-1
Potential Location-Specific ARARs at GANGB

	Location	Requirement	Prerequisite(s)	Citation	ARARs Status	Comments
1.	Within 100-year flood plain	Facility must be designed, constructed, operated, and maintained to avoid washout	RCRA hazardous waste; PCB treatment, storage, or disposal	40 CFR 264.18(b); 40 CFR 761.75	Applicable	Part of Site No. 5 is in the 100-year flood plain.
2.	Within flood plain	Action to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the flood plain	Action that will occur in a flood plain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas	Executive Order 11988, Protection of Flood Plains, (40 CFR 6, Appendix A)	Applicable	Part of Site No. 5 is in the 100-year flood plain.
3.	Wetlands	Action to minimize the destruction, loss, or degradation of wetlands	Wetlands as defined by Executive Order 11990 Section 7	Executive Order 11990, Protection of Wetlands (40 CFR 6, Appendix A)	Applicable	Wetlands are near Site No. 7
		Action to prohibit discharge of dredged or fill material into wetland without permit		Clean Water Act Section 404; 40 CFR Parts 230, 231	Applicable	Wetlands are near Site No. 7

1.7.2.2 Maximum Contaminant Level Goals

The above discussion is also pertinent to the use of MCLGs at GANGB. In addition, MCLGs for carcinogens are zero, and this cleanup standard cannot be detected.

1.7.2.3 Secondary Maximum Contaminant Levels

Federal secondary MCLs are nonenforceable goals for drinking water established by EPA under the SDWA. Secondary MCLs pertain to contaminants that, if present in excessive quantities, may discourage the use of a public water supply because they affect such qualities as taste, color, odor, and corrosivity. Secondary MCLs are listed in 40 CFR 143.

1.7.2.4 Federal Water Quality Criteria

Federal Water Quality Criteria (FAWQC) are developed by EPA under the Clean Water Act. FAWQC are used by the states to set their own water quality standards for surface water. EPA develops two kinds of criteria, one for the protection of human health and another for the protection of aquatic life. FAWQC set quantitative levels of pollutants in water so that water quality is adequate for a specified use. These levels are based solely on data and scientific judgments regarding the relationship between concentrations of a pollutant and resulting effects on environmental and human health. FAWQC do not reflect consideration of economic or technological feasibility. They are typically used by state and federal agencies in setting National Pollutant Discharge Elimination System (NPDES) permit levels. Often, the 7Q10 streamflow (7-day average low flow below which actual flows will occur, on the average, once every 10 years) is used in assigning the amount of dilution allowed for the discharge so that the FAWQC are not exceeded. The FAWQC will be considered as potential ARARs at GANGB to the extent that state water quality standards have not been established.

Human Health Protection. The purpose of FAWQC for human health is to protect humans from hazards associated with three types of exposure--exposure from only drinking the water and exposure from only consuming aquatic organisms, primarily fish, and from consuming both water and aquatic organisms. There are criteria that address exposure from both routes and from the consumption of fish alone. The criteria identify concentrations equating to specified levels of cancer risk (10^{-4}, 10^{-6}, and 10^{-7} for carcinogens) or threshold-level concentrations for noncarcinogens that represent the water concentrations at which there would be no adverse (chronic toxicity) health effects. There are also criteria for chemicals with organoleptic properties (i.e., affecting taste or odor but not health). These criteria are based on concentrations at which there would be no taste or odor problems.

FAWQC are not appropriate for exposures through consumption of groundwater or where exposure is through consumption of drinking water. However, the FAWQC values can be adjusted to reflect exposure solely from drinking the water. Adjusted

values can be adjusted to reflect exposure solely from drinking the water. Adjusted FAWQC values are presented in the *Superfund Public Health Evaluation Manual* published by EPA. FAWQC for human health protection are given in Table 1-2.

Aquatic Life Protection. The FAWQC for the protection of aquatic life present two sets of values. One value is based on the protection of aquatic life from acute exposure and the other from chronic exposure. When data are not sufficient to set a criterion, the lowest reported acute- or chronic-effects level published in the literature is used. Table 1-3 lists FAWQC for protection of aquatic life.

The first water quality criteria were published in *Quality Criteria for Water: 1973* (the Blue Book), were updated in *Quality Criteria for Water: 1976* (the Red Book), and were further updated in *Quality Criteria for Water: 1986* (the Gold Book). In 1980, *Ambient Water Quality Criteria* (45 FR 79318) for the 65 consent decree priority pollutants was published. The FAWQC for aquatic life have been updated periodically since 1980.

1.7.3 STATE ARARS

1.7.3.1 Georgia Rules For Safe Drinking Water (Chapter 391-3-5)

The Georgia Safe Drinking Water Act of 1977 (Act No. 231 O.C.G.A. Section 12-5-170 et. seq.) has established polices, procedures, requirements, and standards to carry out the purposes and requirements of the SDWA (PL93-523). Table 1-4 lists the primary MCLs for inorganic and organic chemicals promulgated by the State of Georgia. These MCLs apply to the permissible level of contaminants in water from the tap of any ultimate user of a water system.

Table 1-5 lists the primary drinking water MCLs and MCLGs for synthetic volatile organic compounds (VOCs). These maximum levels apply to groundwater and surface water (391-3-5-.25). According to the Georgia Department of Natural Resources, inorganic and organic chemicals not specifically regulated but detected in groundwater are compared to background to determine if a release of hazardous substances has occurred.

Table 1-6 lists the secondary contaminant levels for drinking water, promulgated by the State of Georgia to provide water that is aesthetically pleasing and free of odors. These levels apply to the permissible level of contaminants from the tap of the ultimate user of a public water system. Secondary MCLs would not be legally applicable to the cleanup of groundwater and surface water, but may be considered relevant and appropriate in some instances. These secondary MCLs will be placed in the TBC category.

Table 1-2
EPA Drinking Water Standards, Criteria, and Guidelines
(All units μg/l, except as noted)

Chemical	Maximum[a] Contaminant Level (MCL)		Maximum[b] Contaminant Level Goal (MCLG)		Secondary Maximum[c] Contaminant Level (SMCL)		Federal Ambient Water Quality Criteria (FAWQC) for Protection of Human Health: Water & Aquatic Organisms		Aquatic Organisms		Modified for Water Only[d]		Organoleptic Criterion
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	
Aldrin								0.000074		0.000079		0.0012	
Antimony							146		45000		146		
Arsenic	50							0.0022		0.0175		0.0025	
Barium	1000	5000		5000									
Benzene	5		0					0.66		40		067	
Benzo(a)anthracene				0				h		h		h	
Benzo(a)pyrene		0.2		0				h		h		h	
Benzo(b)fluoranthene		0.2		0				h		h		h	
Benzo(k)fluoranthene		0.2		0				h		h		h	
Beryllium		1		0				0.0068		0.12		0.0072	
bis(2-ethylhexyl) phthalate							15000		50000		21000		
Bromodichloromethane	100						i		i		i		
2-Butanone													
Cadmium	10	5		5			10		10		10		

Table 1-2
EPA Drinking Water Standards, Criteria, and Guidelines
(All units µg/l, except as noted)

Chemical	Maximum[a] Contaminant Level (MCL)		Maximum[b] Contaminant Level Goal (MCLG)		Secondary Maximum[c] Contaminant Level (SMCL)		Federal Ambient Water Quality Criteria (FAWQC) for Protection of Human Health						Organoleptic Criterion
							Water & Aquatic Organisms		Aquatic Organisms		Modified for Water Only[d]		
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	
Carbon tetrachloride	5		0					0.4		0.40		0.42	
Chlorobenzene (mono)		100		100			488				488		
Chlordane		2		0				0.00046		0.00048		0.022	
Chloroform	100[g]							0.19		15.7		0.19	
Chromium	50	100		100			50				50		
Chrysene		0.2		0				b		b		b	
Copper		1300		1300	1000								1000
Cyanide		200		200	n		200				200		
DDT								0.000024		0.000024		0.0042	
Dibenzo(a,h)anthrancene		0.2		0				b		b		b	
Dibutyl phthalate		4		0			34000		154000		44000		
1,2-Dichlorobenzene (o)		600		600		10	400		2600		470		
1,4-Dichlorobenzene (p)	75		75			5	400		2600		470		
1,2-Dichloroethene	5		0					0.94		243		0.94	

Table 1-2
EPA Drinking Water Standards, Criteria, and Guidelines
(All units µg/l, except as noted)

Chemical	Maximum[a] Contaminant Level (MCL)		Maximum[b] Contaminant Level Goal (MCLG)		Secondary Maximum[c] Contaminant Level (SMCL)		Federal Ambient Water Quality Criteria (FAWQC) for Protection of Human Health: Water & Aquatic Organisms		Aquatic Organisms		Modified for Water Only[d]		Organoleptic Criterion
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	
1,1-Dichloroethene	7		7					0.033		1.90		0.033	
cis-1,2-Dichloroethene		70		70									
trans-1,3-Dichloroethene		1100		100									
Dieldrin								0.000071		0.000076		0.0011	
Diethyl phthalate		4		0			350000		1800000		434000		
Ethylbenzene		700		700		30	1400		3300		2400		
Halomethanes								0.19		16		0.19	
Iron					300								
Lead	50	5		0			50		520,000		50		
Mangenese					50						50		
Mercury	2	2		2			0.144		0.146		10		
4-Methylphenol													0.1
Nickel		100		100			632				730		
PCB		0.5		0				0.000079		0.000079		0.0126	

Table 1-2
EPA Drinking Water Standards, Criteria, and Guidelines
(All units µg/l, except as noted)

Chemical	Maximum[a] Contaminant Level (MCL)		Maximum[b] Contaminant Level Goal (MCLG)		Secondary Maximum[c] Contaminant Level (SMCL)		Federal Ambient Water Quality Criteria (FAWQC) for Protection of Human Health: Water & Aquatic Organisms		Aquatic Organisms		Modified for Water Only[d]		Organoleptic Criterion
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	
Pentachlorophenol		200		200		30	1010		29400		1010		30
Phenol							3500		769000		3500		
Selenium	10	50		50			10				10		
Silver	50					90	50				50		
Tetrachloroethene		5		0				0.80		9		0.88	
Thallium		2		0.5			13		48		17.8		
Toluene		2000		2000		40	14300		424000		15000		
1,1,1-Trichloroethane	200		200				18400		1030000		19000		
1,1,2-Trichloroethane		5		3				0.6		42		0.60	
Trichloroethene	5		0					2.7		87		2.8	
Trihalomethane (total)	100												
Vinyl chloride	2		0					2.0		525		2	
Xylenes (total)		10000		10000		20							

Table 1-2
EPA Drinking Water Standards, Criteria, and Guidelines
(All units µg/l, except as noted)

Chemical	Maximum[a] Contaminant Level (MCL)		Maximum[b] Contaminant Level Goal (MCLG)		Secondary Maximum[c] Contaminant Level (SMCL)		Federal Ambient Water Quality Criteria (FAWQC) for Protection of Human Health						Organoleptic Criterion
							Water & Aquatic Organisms		Aquatic Organisms		Modified for Water Only[d]		
	Final	Proposed	Final	Proposed	Final	Proposed	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	Toxicity Protection	10-6 Cancer Risk	
Zinc					5000						5000		5000

a Maximum Contaminant Levels (MCLs) are enforceable drinking water standards, developed under the Safe Drinking Water Act, that are set as close to MCLGs as feasible (with the use of the best technology, treatment techniques taking into consideration cost). MCLs are part of National Primary Drinking Water Regulations. MCLs are listed at 40 CFR61 for organic contaminants and 40 CFR 141.62 for inorganic contaminants. Proposed MCLs issued November 1990.

b Maximum Contaminant Level Goal (MCLGs) are non-enforceable health goals, developed under the Safe Drinking Water for drinking water. They are set at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. MCLGs were previously named RMCLs. MCLGs are listed at 40 CFR 141.51 for inorganic chemicals. Proposed MCLGs issued on May 22, 1989 (54 FR 22062) except lead and copper which were issued August 24, 1988 (53 FR 32259).

c Secondary Maximum Contaminant Levels (SMCLs) are part of the National Secondary Drinking Water Regulations developed under the Safe Drinking Water Act. They are not federally enforceable but offer guidance to water systems and states on contaminant levels that protect public welfare. They are based on odor, aesthetics, and appearance. They are listed at 40 CFR 143. Proposed SMCLs issued November 1990.

d Federal Ambient Water Quality Criteria (FAWQC) are nonenforceable guidance, developed under the Clean Water Act to protect designated uses of surface waters. The criteria presented in this table are for the use of surface waters for potable water supply and fishing. The criteria presented are for protection against carcinogenic health efects, noncarcinogenic health effects, and organoleptic effects. EPA considers the maximum protection of human health from carcinogenic effects to be zero exposure. EPA recognized the zero level as unobtainable and presented concentrations representing a range of risks from 101 to 107. The table presents the concentration estimated to be associated with a 106 lifetime cancer risk. The toxicity protection criteria for noncarcinogenic effects presents concentrations which are not expected to produce adverse effects in humans. Organoleptic effects are taste odor problems and are not health based. The FAWQC are listed at 45 FR 79118-79379, November 18, 1980. This table lists four acts of criteria; protection from ingestion of contaminated aquatic organisms and contaminated water; protection from ingestion of contaminated aquatic organisms; protection from ingestion of contaminated water; and protection from organoleptic effects. The third act of criteria are not published FAWQC but criteria modified for the application to g[illegible] ter contamination situations at Superfund sites. These values were published in the "Superfund Public Health Evaluation Manual" (US EPA 1986).

e Drinking water health advisories are informal technical guidance issued [illegible] S. EPA Office of Drinking Water (ODW). They are not legally enforceable standards. They are subject to change as new information becomes available. They are based on data describing noncarcinogenic endpoints. Lifetime health advisories describe concentrations of drinking water contaminants at which health effects would not be anticipated to occur over a lifetime exposure, accounting for other sources of exposure. No lifetime health advisories are issued for carcinogens. A "NRC" is indicated where health advisories have been issued for the chemical for less than lifetime exposures.

f *Million fibers/liter.*

g Standard for total trihalomethane. Trihalomethanes include chloroform, bromoform, bromodichloromethane, and chlorodibromomethane.

h Criteria set for all carcinogenic PAHs: water only = 0.0031 µg/l; water and organisms = 0.0028 µg/l; and organism only = 0.031 µg/l.

i Halomethane criterion is for chloromethane, bromomethane, dichloromethane, bromodichloromethane, tribromomethane, dichlorodofluoromethane, trichlorofluoromethane, or combinations of these chemicals.

j No MCL issued for acrylamide or epichlohydrin because currently, analytical methods do not exist which accurately measure at any level these chemicals. A treatment technique is issued in lieu of an MCL.

k EPA proposes MCLs of 100 µg/l based on a Group C carcinogen classification and 5 µg/l based on a B2 classification.

l EPA proposes MCLGs of 100 µg/l based on a group C Carcinogen classification and 0 µg/l based on a B2 classification.

m Color units

n Non-corrosive

o Threshold odor number

p Standard units

q Nitrate as N

r Nitrite as N

Table 1-3
Criteria for Aquatic Life Protection

Chemical	Federal Ambient Water Quality Criteria[a]						Lowest Reported Effects Level[b]	
	Acute Criteria µg/l			Chronic Criteria µg/l			Acute Criteria µg/l	Chronic Criteria µg/l
Aldrin	4	(2)		-			-	-
Antimony	-			-			9000	1600
Arsenic	360	(3)		190	(3)		3243	812
Barium	-			-			5000	-
Benzene	-			-			5300	-
Beryllium	-			-			130	5.3
Cadmium	8.6	(3)	*	2.0	(3)	*	1	0.15
Carbon tetrachloride	-			-			35200	-
Chlorobenzene	-			-			250	50
Chlordane	2.4	(2)		0.0043	(2)		-	-
Chloroform	-			-			28900	1240
Chromium(hexavalent)	16	(3)		11	(3)		-	-
Copper	34	(3)	*	21	(3)	*	-	-
Cyanide	22	(3)		5.2	(3)		44.73	7.849
DDE	-			-			1050	-
DDT	1.1	(2)		0.0010	(2)		-	-
1,2-Dichlorobenzene (o)	-			-			1120	763
1,4-Dichlorobenzene (p)	-			-			1120	763
1,2-Dichloroethane	-			-			118000	20000
1,1-Dichloroethene	-			-			11600	-
Cis-1,2-Dichloroethene	-			-			11600	-
Trans-1,2-Dichloroethene	-			-			11600	-
Dieldrin	1.0	(2)		0.0019	(2)		-	-
Diethyl Phthalate	-			-			940	3
Di-n-butyl Phthalate	-			-			940	3
Ethylbenzene	-			-			32000	-
Halomethanes	-			-			11000	-
Iron	-			1.0	(1)		-	-
Lead	197	(3)	*	7.7	(3)	*	-	-
Mercury (inorganic)	2.4	(3)		0.012	(3)		-	-

Table 1-3
Criteria for Aquatic Life Protection

Chemical	Federal Ambient Water Quality Criteria[a]						Lowest Reported Effects Level[b]	
	Acute Criteria µg/l			Chronic Criteria µg/l			Acute Criteria µg/l	Chronic Criteria µg/l
Nickel	3124	(2)	*	162	(2)	*	-	-
PCBs	2.0	(2)		0.014	(2)		-	-
Pentachlorophenol	-			-			55	3.2
Phenol	-			-			10200	2560
Selenium	20	(5)		5	(5)		-	-
Silver	13.4	(2)	*	-			-	0.12
Tetrachloroethene	-			-			5280	840
Thallium	-			-			1400	40
Toluene	-			-			17500	-
1.1.1-Trichloroethane	-			-			18000	-
1.1.2-Trichloroethane	-			-			18000	2400
Trichloroethene	-			-			45000	-
Zinc	211	(4)	*	191	(4)	*	-	-

[a] Federal Water Quality Criteria for Protection of Freshwater Aquatic Life. From the following sources:
(1) From "Quality Criteria for Water" (Gold Book). U.S. EPA: July; 1986
(2) From 45 FR 79318. November 1980. Ambient Water Quality Criteria: Availability of Documents. Acute criterion reflects a concentration which should not be exceeded at any time Chronic criterion relects an average concentration over a 24-hour period.
(3) From 50 FR 30784. July 29, 1985. Ambient Water Quality Criteria: Availability of Documents. Acute criterion reflects a one hour average not to be exceeded more than once every three years on average. Chronic criterion reflects a 4-day average concentration not to be exceeded more than once in three years on the average.
(4) From 52 FR 6213. March 2, 1987. Ambient Water Quality Criteria: Availability of Documents. Acute criterion reflects a one hour average not to be exceeded more than once every three years on average. Chronic criterion reflects a 4-day average concentration not to be exceeded more than once in three years on the average.
(5) From 53 FR 177. January 5, 1988. Ambient Water Quality Criteria: Availability of Documents. Acute criterion reflects a one hour average not to be exceeded more than once every three years on average. Chronic criterion reflects a 4-day average concentration not to be exceeded more than once in three years on the average.

[b] Not enough data were available to derive a numerical national water quality criteria for aquatic life protection for these chemicals. Values reflect lowest reported effects levels. From 45 FR 79318. November 1980.

* Assumed hardness 200 mg/l

Note: Criterion is dependent on the hardness of the water.

TABLE 1-4
STATE OF GEORGIA
PRIMARY MCLS FOR INORGANIC AND ORGANIC CHEMICALS[a]

CONTAMINANT	MCL (mg/l)
Arsenic (As)	0.05
Barium (Ba)	1
Cadmium (Cd)	0.010
Chromium (Cr)	0.05
Chlorinated Hydrocarbons:	
- Endrin	0.0002
- Lindane	0.004
- Methoxychlor	0.1
- Toxaphene	0.005
Chlorophenoxys:	
- 2,4,-D, (2,4,-Dichlorphenoxyacetic acid).	0.1
- 2,4,5-TP Silvex (2,4,5,-Trichlorophenoxypropionic acid).	0.01
Fluoride (F)	4.0
Lead (Pb)	0.05
Mercury (Hg)	0.002
Nitrate (as N)	10
Selenium (Se)	0.01
Silver (Ag)	0.05

MCL = Maximum Contaminant Level

[a]Rules for Safe Drinking Water, Georgia
Department of Natural Resources (Chapter 391-3-5-.18)

TABLE 1-5
STATE OF GEORGIA
PRIMARY MCLS AND MCLGS
FOR VOLATILE SYNTHETIC ORGANIC CHEMICALS

CONTAMINANT	MCL (mg/l)	MCLG (mg/l)
Benzene	0.005	zero
Carbon tetrachloride	0.005	zero
para-Dichlorobenzene	0.075	0.075
Trichloroethylenne	0.005	zero
Vinyl chloride	0.002	zero
1,1 - Dichloroethylene	0.007	0.007
1,1,1 - Trichloroethane	0.2	0.20
1,2 - Dichloroethane	0.005	zero

MCL = Maximum Contaminant Level

MCLG = Maximum Contaminant Level Goal

Source: Rules for Safe Drinking Water, Georgia Department of Natural Resources (Chapter 391-3-5-.18)

TABLE 1-6
STATE OF GEORGIA
SECONDARY MCLS FOR DRINKING WATER

SUBSTANCE	SECONDARY MCL (mg/l)
Chloride (Cl)	250
Color	15 color units
Copper (Cu)	1
Fluoride (F)	2.0
Foaming agents	0.5
Iron (Fe)	0.3
Manganese	0.05
Sulfate (S04)	250
Total Dissolved Solids (TDS)	500
Zinc (Zn)	5

MCL = Maximum Contaminant Level

Source: Rules for Safe Drinking Water, Georgia Department of Natural Resources (Chapter 391-3-5-.19)

1.7.3.2 Georgia Water Use Classifications and Water Quality Standards

The Water Use Classifications and Water Quality Standards of the Georgia Water Quality Control Act are published in Chapter 391-3-6-03 in the *Georgia Rules and Regulations for Water Quality Control.* The purposes of these standards are "to provide enhancement of water quality and prevention of pollution; to protect the public health or welfare in accordance with the public interest for drinking water supplies, conservation of fish, game and other beneficial aquatic life, and agricultural, industrial, recreational, and other reasonable and necessary uses." With regard to these regulations, the state has adopted criteria that must not be exceeded except for some of the toxic priority pollutants within certain mixing zones. These criteria are in compliance with Section 307(a)(1) of the federal Clean Water Act, as amended.

Table 1-7 lists quality standards deemed applicable and necessary by the State of Georgia as they apply to in-stream contaminant concentrations in all "surface waters" of the state. "Surface waters" include any and all rivers, streams, creeks, branches, natural lakes, tributary streams, artificial reservoirs or impoundments, ponds, drainage basins, and groundwater under direct influence of surface water (Georgia Rules for Safe Drinking Water 391-3-5.02[k]). According to Georgia water quality standards, all surface waters shall be free from toxic, corrosive, acidic, and caustic substances discharged from municipalities, industries, or other sources, such as non-point sources. These standards are promulgated by the state and are potential ARARs for cleanup levels at GANGB.

1.7.3.3 Petroleum Contaminated Soil and Groundwater

The State has promulgated rules regarding petroleum contaminated soil and groundwater originating from underground storage tanks (Chapter 391-3-15). This rule requires soils containing 100 mg/kg TPH or 20 mg/kg total benzene, toluene, ethylbenzene and xylene (total BTEX) to be remediated if the source is within three miles of a public drinking water well or within one-half mile of a private drinking water well. Under this rule, groundwater will be remediated to State and Federal MCLs. These standards may not apply if the drinking water wells are upgradient of the contamination source or not hydraulically connected.

At other underground storage sites (greater than three miles from public drinking water wells or greater than one-half mile from private drinking water wells) where petroleum contamination has been detected, soils containing 500 mg/kg TPH or 100 mg/kg total BTEX are to be remediated. Groundwater is to be monitored for contaminant plume movement. Sites investigated at GANGB did not involve underground storage tanks, therefore, this rule would not be an ARAR.

1.7.4 Summary

The ARARs presented here will need to be applied to the results of this SI. In general, the following standards will be the most applicable. Groundwater con-

TABLE 1-7
INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[a]

Chemical	Instream MCL μg/l
Acenaphthene[c]	20
Acenaphthylene[c]	.0311
Acrolein[c]	780
Acrylonitrile[c]	0.665
Aldrin[c]	0.000136
Anthracene[c]	.0311
Antimony[c]	4308
Arsenic[b] - Freshwater	50
Arsenic[b] - Coastal and Marine Estuarine Waters	36
Arsenic[c]	0.14
Benzene[c]	71.28
Benzidine[c]	.000535
Benzo(a)Anthracene[c]	.0311
Benzo(a)Pyrene[c]	.0311
Benzo(ghi)Perylene[c]	.0311
Benzo(k)Fluoranthene[c]	.0311
3,4-Benzofluoranthene[c]	0311
Beryllium[c]	0.117
a-BHC-Alpha[c]	.0131
b-BHC-Beta[c]	.046
Bis(2-Chloroisopropyl)Ether[c]	4360
Bis(2-Ethylhexyl)Phthalate[c]	5.92
Bis(2-Chloroethyl)Ether[c]	1.42
Bromoform (Tribromomethane)[c]	470.8
Cadmium[be] (at hardness levels less than 100 mg/)	0.7
Cadmium[be] (at hardness levels of 100 mg/l to 199 mg/l)	1.1
Cadmium[be] (at hardness levels greater than or equal to 200 mg/l)	2.0
Carbon Tetrachloride[c]	4.42

TABLE 1-7
INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[a]

Chemical	Instream MCL $\mu g/l$
Chlordane[b] - Freshwater	.0043
Chlordane[b] - Saltwater	.004
Chlordane[c]	0.000588
Chlorobenzene[c]	20
Chlorodibromomethane[c]	470.8
2-Chloroethylvinyl Ether[c]	17.6
Chloroform (Trichloromethane)[c]	470.8
2-Chlorophenol[c]	0.1
Chromium(VI)[b]	11
Chromium Total[b,e] •(at hardness levels less than 100mg/l in freshwater)	120
Chromium Total[b,e] •(at hardness levels of 100 mg/l to 199 mg/l in freshwater)	210
Chromium Total[b,e] •(at hardness levels greater than or equal to 200 mg/l in freshwater)	370
Chromium Total[b] - Coastal and Marine Estuarine Waters	50
Chrysene[c]	.0311
Copper[b,e] •(at hardness levels less than 100 mg/l in freshwater)	6.5
Copper[b,e] •(at hardness levels of 100 mg/l to 199 mg/l in freshwater)	12
Copper[b,e] •(at hardness levels greater than or equal to 200 mg/l in freshwater)	21
Copper[b] - Coastal and Marine Estuarine Waters	2.9
Cyanide[b]- Freshwater	5.2
Cyanide[b]- Coastal and Marine Estuarine Waters	1.0
4,4'-DDT[b]	.001
4,4'-DDT[c]	0.00059
Di-n-Butyl Phthalate[c]	12100
Dibenzo(a,h)Anthracene[c]	.0311
1,2-Dichlorobenzene[c]	2600
1,3-Dichlorobenzene[c]	2600
1,4-Dichlorobenzene[c]	2600
3,3-Dichlorobenzidine[c]	0.02
Dichlorobromomethane[c]	470.8

TABLE 1-7
INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[d]

Chemical	Instream MCL $\mu g/l$
1,2-Dichloroethane[c]	98.6
1,1-Dichloroethylene[c]	3.2
2,4-Dichlorophenol[c]	0.3
2,4-Dichlorphenoxyacetic acid (2,4-D)[a]	100
1,3-Dichloropropylene(Trans)[c]	31.3
1,3-Dichloropropylene(Cis)[c]	31.3
Dieldrin[b]	.0019
Dieldrin[c]	0.000144
2,4-Dimethylphenol[c]	400
Dimethyl Phthalate[c]	2900000
2,4-Dinitrophenol[c]	14264
2,4-Dinitrotoluene[c]	9.1
1,2-Diphenylhydrazine	0.54
a-Endosulfan[b] - Freshwater	.056
a-Endosulfan[b] - Coastal and Marine Estuarine Waters	.0087
b-Endosulfan[b] - Freshwater	.056
b-Endosulfan[b] - Coastal and Marine Estuarine Waters	.0087
Endrin[b]	0.002
Ethylbenzene[c]	28718
Fluoranthene[c]	54
Fluorene[c]	0.031
Heptachlor[b] - Freshwater	.0038
Heptachlor[b] - Saltwater	.0036
Heptachlor[c]	0.000214
Heptachlor Epoxide[b] - Freshwater	.0038
Heptachlor Epoxide[b] - Saltwater	.0036
Heptachlor Epoxide[c]	0.000214
Hexachlorobenzene[c]	0.00074
Hexachlorobutadiene[c]	49.7

TABLE 1-7 (con't) INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[a]	
Chemical	**Instream MCL $\mu g/l$**
Hexachlorocyclopentadiene[c]	1.0
Hexachloroethane[c]	8.85
Indeno(1,2,3-cd)Pyrene[c]	.0311
Isophorone[c]	520000
Lead[be] •(at hardness levels less than 100 mg/l in freshwater)	1.3
Lead[be] •(at hardness levels 100 mg/l to 199 mg/l in freshwater)	3.2
Lead[be] •(at hardness levels greater than or equal to 200 mg/l in freshwater)	7.7
Lead[b] - Coastal and Marine Estuarine Waters	5.6
Lindane[b] [Hexachlorocyclohexane (g-BH-Gamma)]	0.08
Lindane[c] [Hexachlorocyclohexane (g-BH-Gamma)]	.0625
Mercury[b]	0.01
Methoxyclor[a]	0.03
Methyl Bromide (Bromomethane)[c]	470.8
Methyl Chloride (Chloromethane)[c]	470.8
3-Methyl 4-Chlorophenol[c]	3000
2-Methyl 4,6-Dinitrophenol[c]	765
Methylene Chloride[c]	1578
Nickel[be] •(at hardness levels less than 100 mg/l in freshwater)	88
Nickel[be] •(at hardness levels of 100 mg/l to 199 mg/l in freshwater)	160
Nickel[be] •(at hardness levels greater than or equal to 200 mg/l in freshwater)	280
Nickel[b] - Coastal and Marine Estuarine Waters	8.3
Nitrobenzene[c]	30
N-Nitrosodi-n-Propylamine[c]	8.55
N-Nitrosodimethylamine[c]	8.12
N-Nitrosodiphenylamine[c]	16.2
PCB-1016[b]	.014
PCB-1016[c]	0.00045
PCB-1221[b]	.014
PCB-1221[c]	0.00045

TABLE 1-7 (con't)
INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[a]

Chemical	Instream MCL μg/l
PCB-1232[b]	.014
PCB-1232[c]	0.00045
PCB-1242[b]	.014
PCB-1242[c]	0.00045
PCB-1254[b]	.014
PCB-1254[c]	0.00045
PCB-1248[b]	.014
PCB-1248[c]	0.00045
PCB-1260[b]	.014
PCB-1260[c]	0.00045
Pentachlorophenol[b]	2.1
Phenanthrene[c]	.0311
Phenol[b]	300
Pyrene[c]	.0311
Selenium[b]	5.0
Silver[b]	0.12
1,1,2,2-Tetrachloroethane[c]	10.8
Tetrachloroethylene[c]	8.85
Thallium[c]	48
Toluene[c]	301941
Toxaphene[b]	.0002
1,2-Trans-Dichloroethylene[c]	136319
1,2,4-Trichlorobenzene[c]	15385
1,1,2-Trichloroethane[c]	41.99
Trichloroethylene[c]	80.7
2,4,6-Trichlorophenol[c]	3.6
2,4,5-Trichlorophenoxy propionic acid (TP Silvex)[a]	10
Vinyl Chloride[c]	525
Zinc[b•] •(at hardness levels less than 100 mg/l in freshwater)	60

TABLE 1-7 (con't)
INSTREAM QUALITY CRITERIA FOR ALL SURFICIAL GEORGIA WATERS[d]

Chemical	Instream MCL µg/l
Zinc[be] •(at hardness levels of 100 mg/l to 199 mg/l)	110
Zinc[be] •(at hardness levels greater than or equal to 200 mg/l)	190
Zinc[b] - Coastal and Marine Estuarine Waters	86

MCL = Maximum Contaminant Level

a) Recognized as pollutants of concern by the State of Georgia. Concentration shall not exceed the criteria indicated under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones.

b) Concentration shall not exceed criteria indicated under 7-day, 10-year minimum flow (7Q10) or higher stream flow conditions except within established mixing zones [FCWA Section 307(a)(1)].

c) Concentration shall not exceed criteria indicated above under annual average or higher stream flow conditions [FCWA Section 307(a)(1)].

d) Source: Rules and Regulations for Water Quality Control, Chapter 391-3-6, Georgia Department of Natural Resources. Revised July 26, 1990.

e) Total hardness expressed as $CaCO_3$

taminants will be compared to MCLs for volatile organics as listed in Table 1-4 and Table 1-5. Organic or inorganic constituents not listed in Table 1-4 or Table 1-5 will be compared to background, upgradient, or other typical values. For surface water, instream concentrations will be compared to instream quality criteria listed in Table 1-7. For soils and sediments, background concentrations or other typical values will be considered in assessing whether a release has occurred.

Section 2
FIELD PROGRAM

The primary objectives of the SI were to determine whether past site activities have resulted in contamination of soil, groundwater, surface water, and sediments; to assess the potential impacts of the contamination on human health and the environment; and to recommend the course of further IRP activities. A two-step approach consisting of field screening and confirmatory-sampling was implemented to meet these objectives. Except as noted in this report, SI activities were performed in accordance with the *Site Investigation Sampling and Analysis Plan* (March 1990). The specific elements of the field program were reviewed and approved by the ANGRC and Hazardous Waste Remediation Action Program (HAZWRAP) before initiating the field program.

The results of the field screening were used to modify confirmatory-sampling locations to more accurately reflect site conditions. The field-screening variables that were considered included groundwater flow direction, the detection of visible contamination, and the detection of contamination.

Following the completion of the field screening, groundwater elevations (collected on July 13, 1990) were plotted to estimate flow patterns and gradients. The results of the field-screening activities and the groundwater data were reviewed with HAZWRAP personnel to establish the locations of the permanent monitor wells. At sites where contamination was detected, monitor wells were placed downgradient of sources of contamination. At sites where no contamination was detected, wells were placed in strategic locations to describe groundwater quality around and downgradient of the sites.

The following subsections describe the activities performed during the field screening and confirmatory sampling, the investigation-derived waste management procedures, and deviations from the *Site Investigation Sampling and Analysis Plan* (March 1990). A summary of SI field activities is shown in Table 2-1.

2.1 FIELD SCREENING

The first step in the SI is referred to as the field screening. Field-screening activities were conducted to assess sites for potential contamination and to aid in examining the types of confirmatory sampling necessary and selecting sampling locations. The field-screening activities consisted of performing an SOV survey, collecting soil-boring and hand-auger headspace samples, installing piezometers, performing a top-of-casing survey, and measuring water levels. The hand-auger and soil-boring logs are in Appendix A. Appendix B contains a technical memorandum issued October 19, 1990, describing the field-screening results and the decision to change some of the proposed

Table 2-1
Summary of Field Activities
Georgia Air National Guard Base
Savannah, Georgia

Activity	Site No. 1	Site No. 2	Site No. 5	Site No. 6	Site No. 7	Site No. 8	Site No. 9	Site No. 10	Site No. 11	Background Site
Soil Organic Vapor Survey[a]										
Sampling Points	10	0	30	0[b]	11	27	23	5	30	0
Hand-Augured Borings[a]										
Sampling Points	0	0	13	18	0	0	4	0	0	0
Soil Samples[c]	0	0	2	4	0	0	0	0	0	0
Soil Borings[a]										
Boring Locations	1	1	5	0	2	3	5	1	2	0
Soil Samples[c]	2	2	8	0	2	6	8	2	4	0
Piezometer Installation[a]	4	0	2	2	1	0	3	3	0	0
Monitor Well Installation[d]	2	1	4	1	1	4	4	1	3	1
Groundwater Samples[d]	3	1	7	2	1	5	5	1	5	1
Surface Water Samples[d]	5	2	0	0	3	5	3	0	0	0
Sediment Samples[d]	12	4	0	0	4	6	1	0	0	0

[a] Conducted during field screening (Step 1 of Site Investigation).
[b] No soil vapor samples were analyzed at Site No. 6 because the water table was too shallow in this area to collect in situ soil gas.
[c] Number of samples indicates only those samples sent to laboratory for analysis.
[d] Conducted during confirmatory sampling (Step 2 of Site Investigation).
[e] Installed at Site No. 9.

locations of permanent monitoring wells based on these results. The piezometer construction diagrams are in Appendix C.

2.1.1 SITE NO. 1--CRTC HANGAR AND WASHRACK DISCHARGE POINT

Figure 2-1 shows the field-screening sample locations. An SOV survey, consisting of ten sampling points, was performed around the washrack and receiving ditch. Six of the SOV samples were collected near the washrack to evaluate runoff from the pavement. Two SOV samples were collected at the discharge point, and two SOV samples were collected at the intersection of the ditch and the GANGB boundary. The SOV samples were screened in the field using a portable gas chromatograph. The location of some SOV sample points were surveyed to reference the sampling point.

One soil boring was performed near the washrack to classify the site-specific lithology and obtain soil samples. The boring was performed to the approximate depth of the groundwater surface. Soil samples obtained from the boring were screened using a field gas chromatograph, and on the basis of the results of this screening, two samples were sent to the laboratory for analysis of volatile organic compounds (VOCs), polynuclear aromatic hydrocarbon (PAH) compounds, total petroleum hydrocarbon (TPH), and priority pollutant metals.

Four temporary piezometers were installed: three surrounding the washrack and one near the discharge point. The piezometers were surveyed to establish referenced vertical datum and horizontal locations. On July 13, 1990, and October 3, 1990, groundwater elevations were gathered from each piezometer and the drainage ditch to establish groundwater gradients and flow directions.

2.1.2 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

Figure 2-2 shows the field-screening sample locations. An SOV survey was not performed at Site No. 2 because discharges from this site reportedly flowed directly into a storm drain connected to a drainage ditch. One soil boring was performed between the washing area and the drainage ditch to classify the site-specific lithology and obtain soil samples. The soil boring was performed to the approximate depth of the groundwater surface. Soil samples obtained from the boring were screened using a field gas chromatograph, and two samples were sent to the laboratory for analysis of VOCs, PAH compounds, and TPH. Because metal contamination was not expected at this site, the samples were not analyzed for priority pollutant metals.

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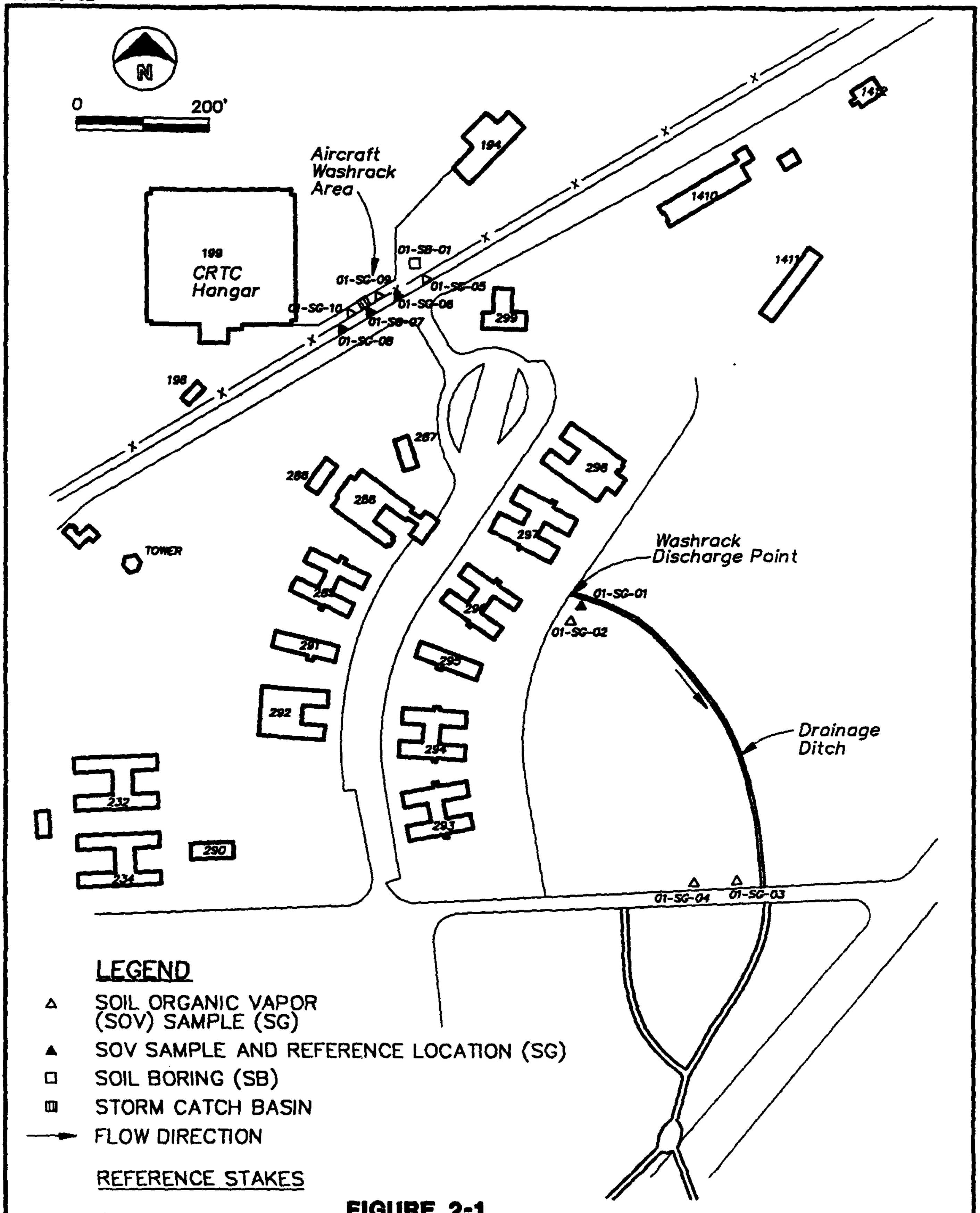

LEGEND

- △ SOIL ORGANIC VAPOR (SOV) SAMPLE (SG)
- ▲ SOV SAMPLE AND REFERENCE LOCATION (SG)
- □ SOIL BORING (SB)
- ▥ STORM CATCH BASIN
- → FLOW DIRECTION

REFERENCE STAKES

01-SG-01
01-SG-06
01-SG-07
01-SG-08

FIGURE 2-1

SITE NO. 1
CRTC HANGAR AND WASHRACK DISCHARGE POINT
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

01-20-92

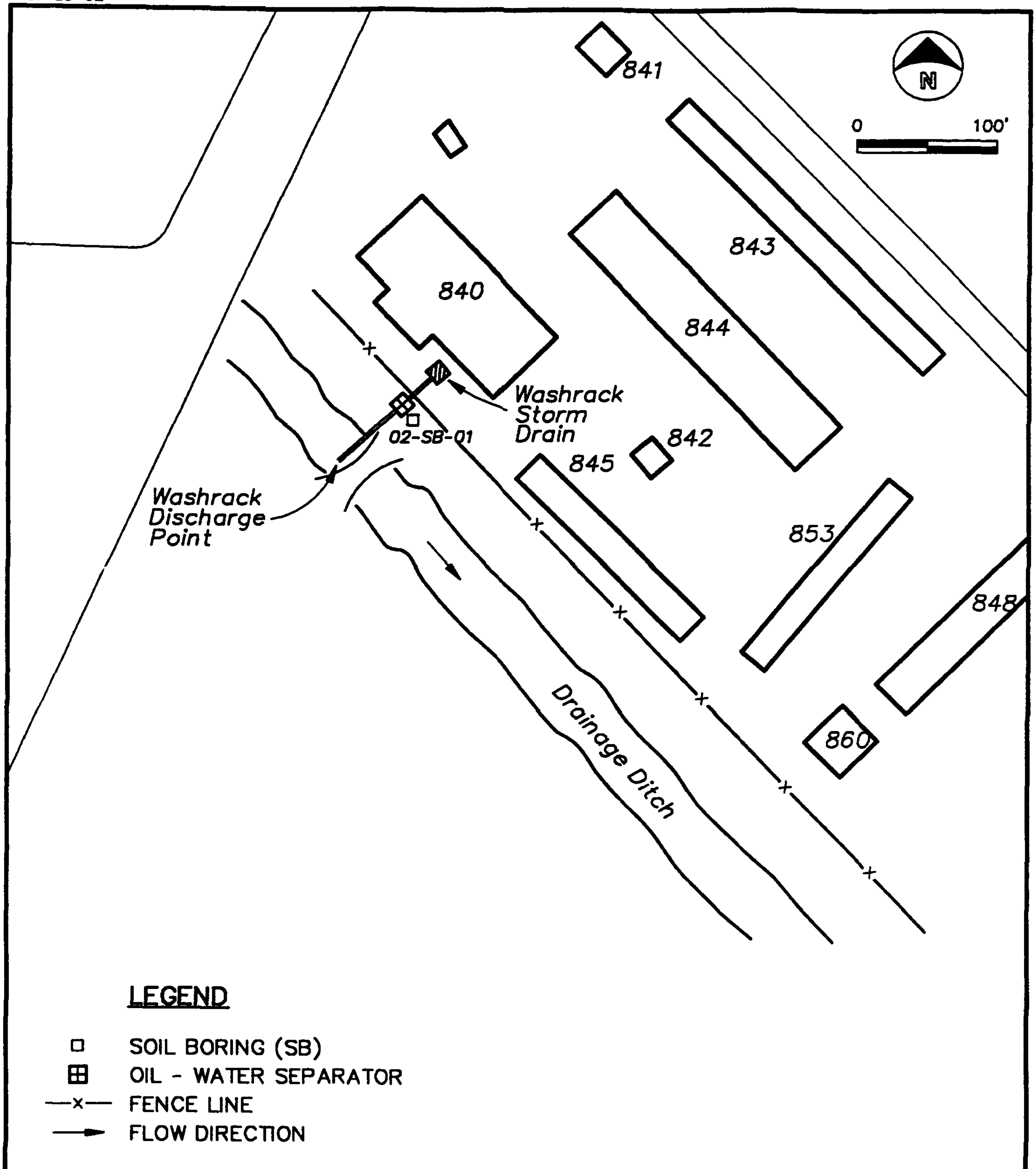

FIGURE 2-2

SITE NO. 2
CRTC VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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2.1.3 SITE NO. 5--165TH BULK FUEL FACILITY

Because two separate sources of contamination may have been present at this site, the field screening was performed in the area of an offsite spill and on the perimeter of the Bulk Fuel Facility. The field screening was performed around the perimeter of the Bulk Fuel Facility because it is a large site and the locations of potential contamination are unknown. Figure 2-3 shows the field-screening sample locations.

The field screening of the offsite spill area included hand augering eight shallow borings to the depth of the groundwater surface, approximately 3 feet bls. The soil borings were located along the railroad tracks where the spilled fuel had migrated and was dammed. Soil samples were collected from each boring, visually inspected, and screened with an hNu. Two hand-auger-boring samples were also sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

An SOV survey was performed around the perimeter of the Bulk Fuel Facility and in the spill area. SOV sampling points were located at approximately 50-foot centers were analyzed using a field gas chromatograph. The survey was used to identify "hot spots" and to assist in the placement of soil borings and monitor wells. In low-lying wet areas where SOV methods were unsuitable, five soil samples (and one duplicate) were collected from hand-auger borings and analyzed using the field gas chromatograph. Because borings were used only to collect soil samples for "Head-space" analysis, logs were not prepared.

Soil borings were performed at five locations around the perimeter of the Bulk Fuel Facility to describe the site-specific lithology and obtain soil samples. Two soil samples were collected from each boring and screened in the field using a gas chromatograph. Because of the results of the SOV screening, eight soil samples (and one duplicate) were collected from four borings (two from each boring) and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

Two piezometers were installed adjacent to the Bulk Fuel Facility. Measurements from these piezometers were used along with measurements from two existing wells to supply potentiometric data. Groundwater elevations and gradients were determined to identify downgradient flow direction.

2.1.4 SITE NO. 6--165TH VEHICLE MAINTENANCE SPILL AREA

The field-screening activities were concentrated east and south of the location where a fuel spill had reportedly accumulated. Figure 2-4 shows the field-screening sample locations. Because the water table in this area was too shallow to conduct an SOV survey, head-space samples were collected from 18 hand-auger borings and analyzed using a field gas chromatograph. The hand-auger borings were also screened by

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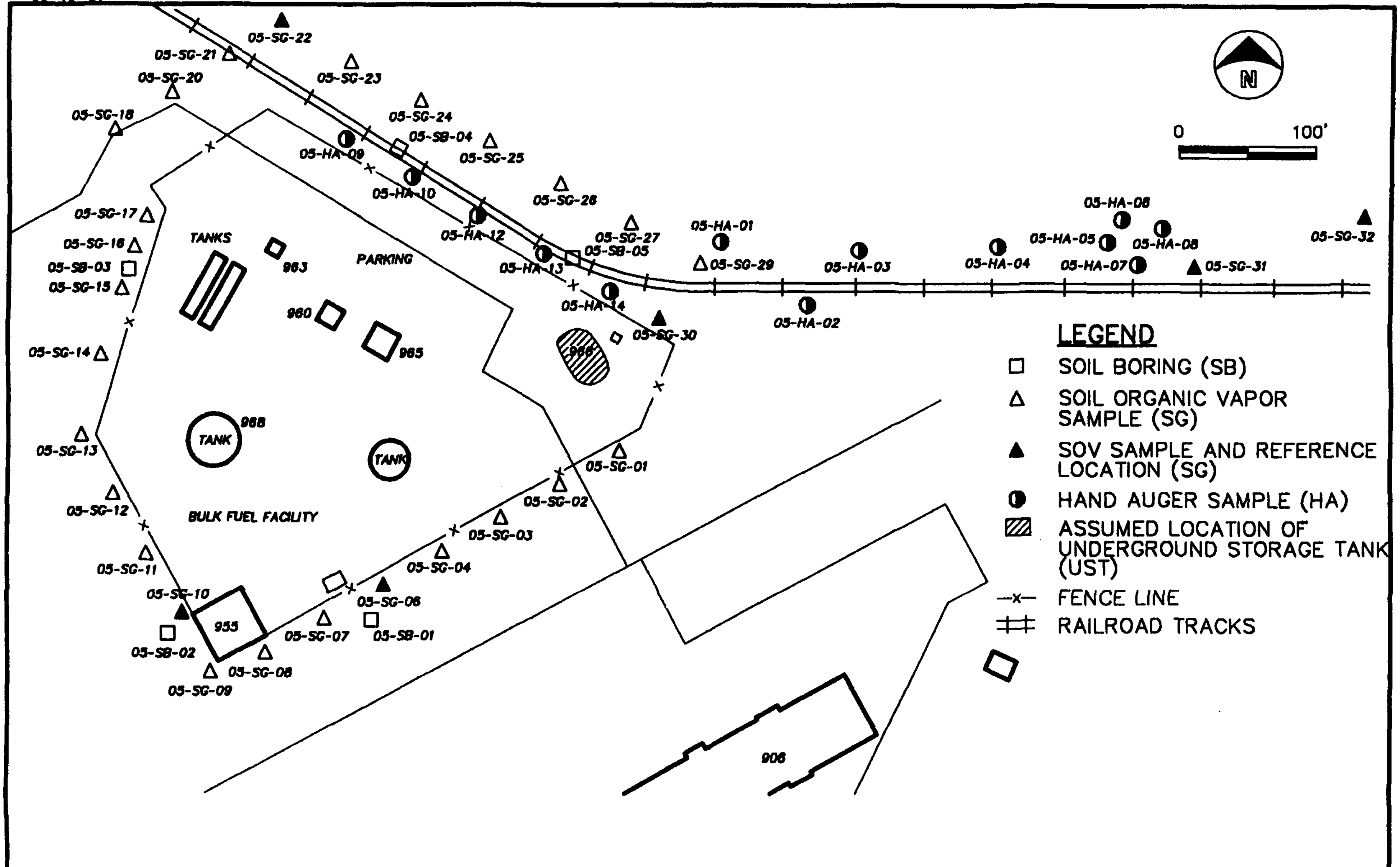

FIGURE 2-3

SITE NO. 5
165th BULK FUEL FACILITY
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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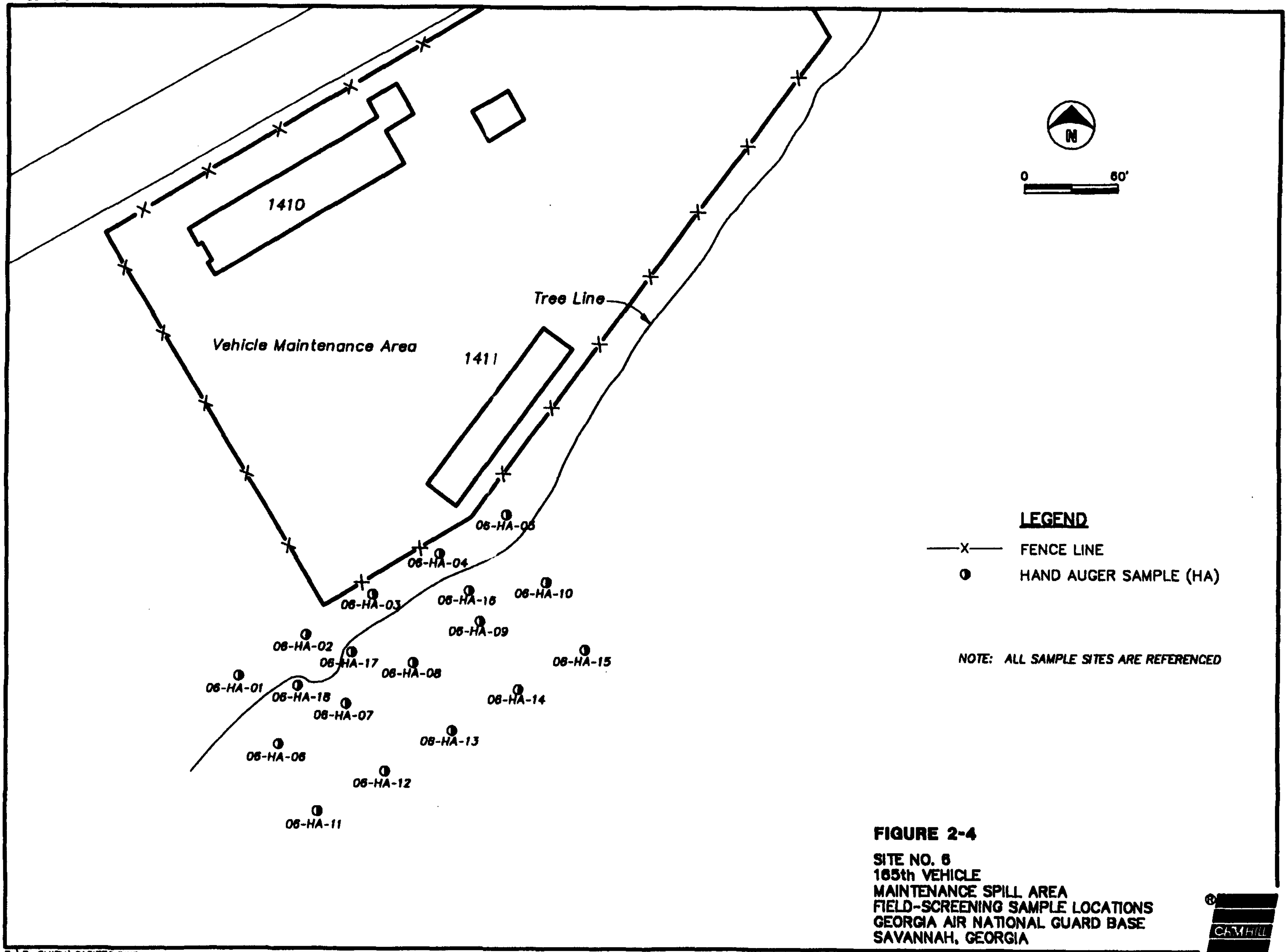

FIGURE 2-4

SITE NO. 6
165th VEHICLE
MAINTENANCE SPILL AREA
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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visual inspection and hNu measurements. Four soil samples from the borings were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

Two piezometers were installed at Site No. 6. Because of the proximity of Site No. 6 to Site No. 7, measurements from piezometers installed at both sites were used to describe the sites' hydrology. Groundwater gradients and flow directions were estimated using groundwater elevations and surface water elevations from the drainage ditch adjacent to Site No. 7.

2.1.5 SITE NO. 7--165TH VEHICLE MAINTENANCE WASHRACK

Figure 2-5 shows the field-screening sample locations. An SOV survey was performed in the area between the washrack and the drainage ditch. A grid system was established to investigate an area approximately 100 feet by 100 feet. Eleven samples were collected at about 50-foot centers and analyzed using a field gas chromatograph.

Two soil borings were performed to describe the site-specific lithology and to obtain soil samples. The first soil boring was abandoned when petroleum based contamination was visually observed in combination with elevated hNu readings. Soil samples obtained from the second boring were screened using a field gas chromatograph. Because of the results of the field screening, two soil samples were sent to the laboratory for analysis of VOCs, PAH compounds, and TPH.

Because Site No. 7 is near Site No. 6, where two piezometers were installed, only one piezometer was installed at Site No. 7. Groundwater flow direction and gradients were estimated using measurements obtained from the piezometers at Site No. 7 and Site No. 6 and from surface water measurements obtained from an adjacent ditch.

2.1.6 SITE NO. 8--OLD 165TH AIRCRAFT WASHRACK

Figure 2-6 shows the field-screening sample locations. An SOV survey was performed in the areas south and southeast of the washrack to screen for residual contamination. This area is the point of greatest topographic relief and would therefore capture, or accumulate, contaminated runoff from the washrack area. Twenty-seven SOV samples were collected at approximately 50-foot centers within two sampling grids; an area approximately 300-feet-by-100 feet south of the washrack and an area approximately 100 feet-by-100 feet southeast of the washrack.

Three soil borings were performed in locations where the SOV survey indicated the presence of contamination. The borings were performed to describe the site-specific lithology and to obtain soil samples. The soil samples were screened in the field using a portable gas chromatograph, and as a result of the concentrations detected, six samples (two from each of the three soil borings) were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

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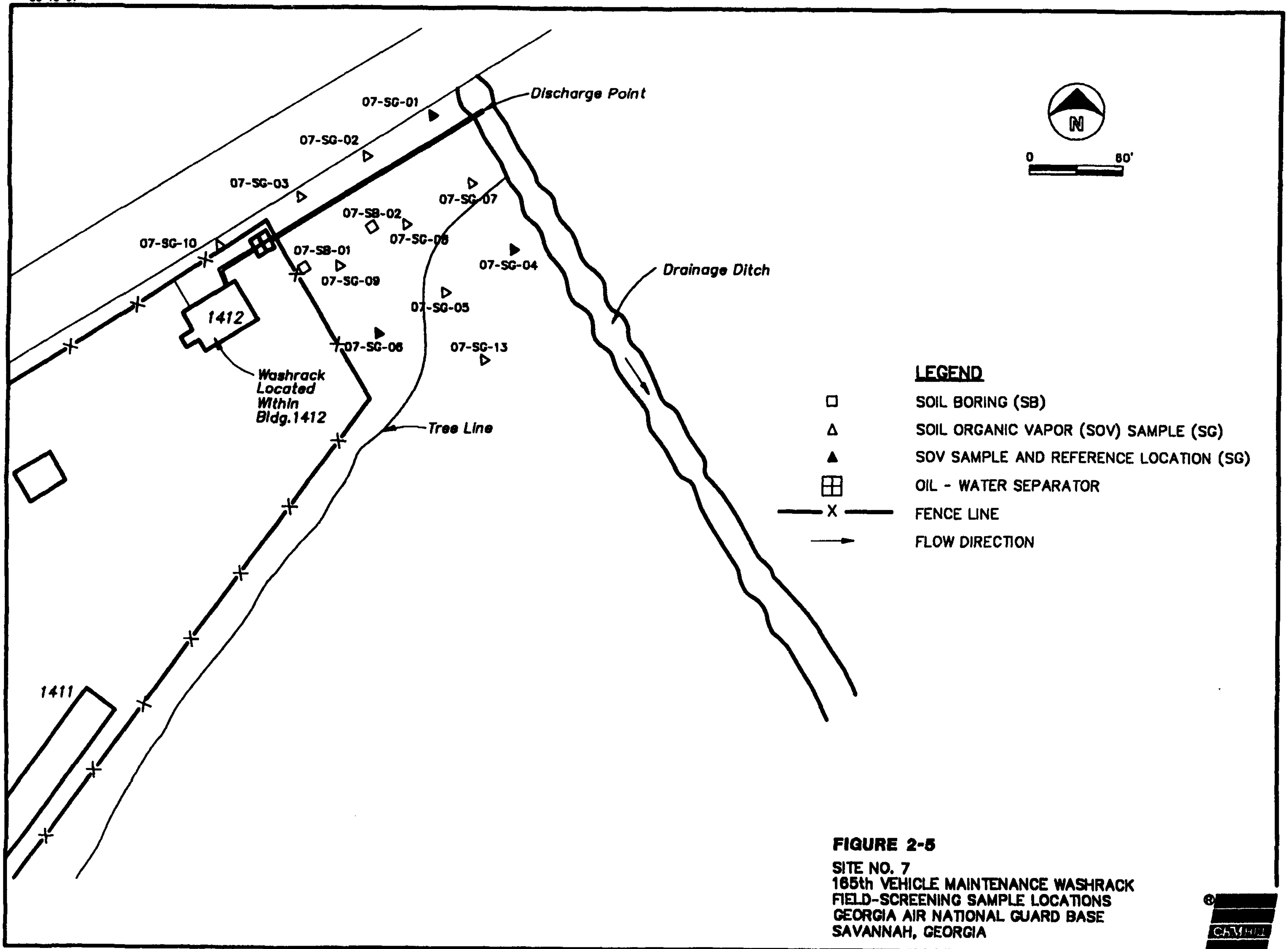

FIGURE 2-5

SITE NO. 7
165th VEHICLE MAINTENANCE WASHRACK
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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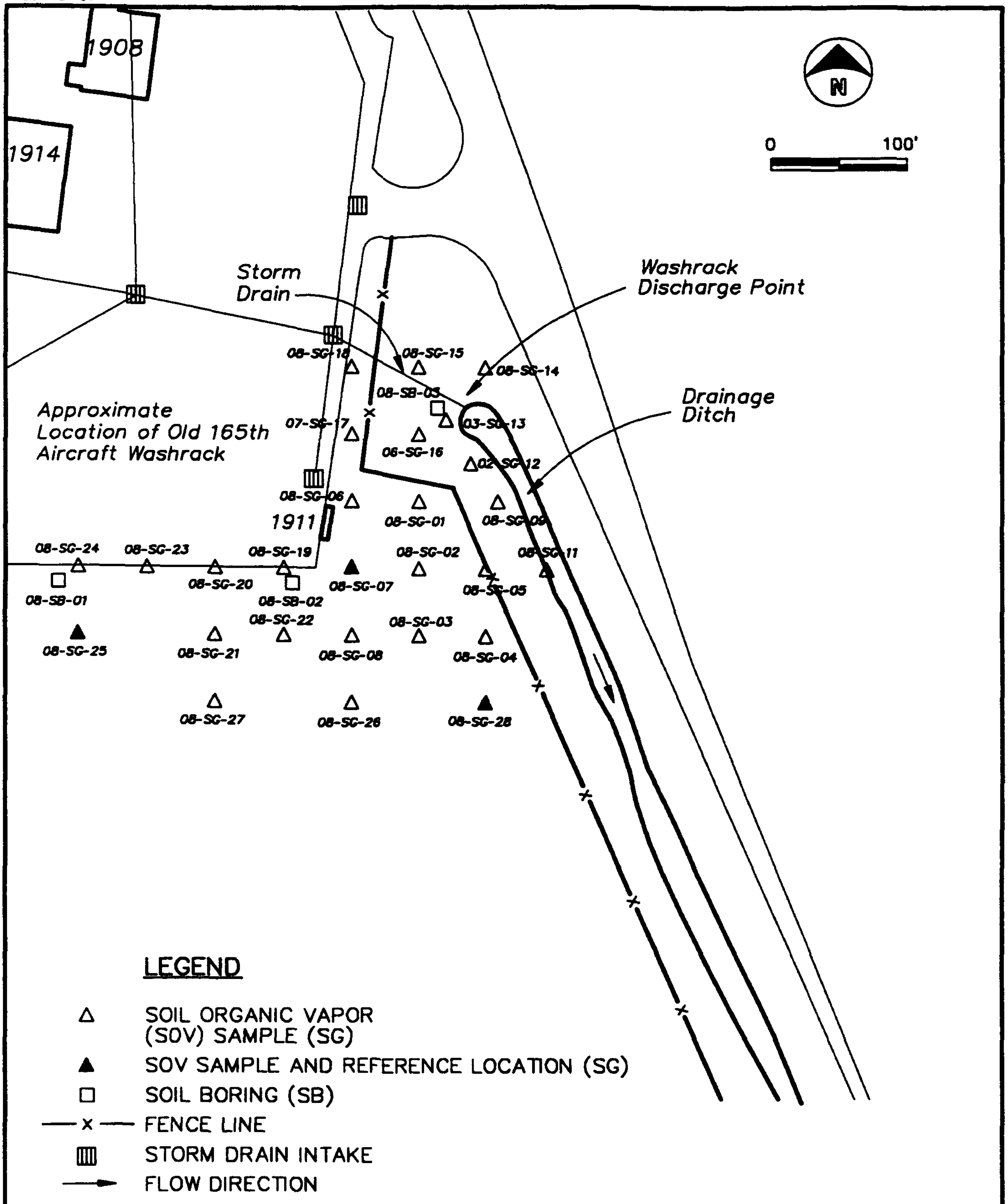

FIGURE 2-6

SITE NO. 8
OLD 165th AIRCRAFT WASHRACK
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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Because of the topography and surface drainage features of this site, it was assumed that groundwater flows east-southeast toward the drainage ditch. In addition, groundwater was observed flowing into the ditch from the direction of Site No. 8. Therefore, no piezometers were installed at the site. A permanent benchmark was established at the drainage ditch to measure the surface water elevation.

2.1.7. SITE NO. 9--165TH CURRENT FIRE TRAINING AREA

Figure 2-7 shows the field-screening sample locations. Field screening was performed to identify contamination in the area surrounding the Fire Training Area and at the point of discharge into a drainage ditch. An SOV survey consisting of 23 sampling points was performed in the areas surrounding the site. The SOV samples were analyzed using a field gas chromatograph. Some of the sample locations originally proposed for SOV sampling were located in a swale where the water table was too high. Consequently, four hand-auger samples were collected and analyzed using the field gas chromatograph.

Five soil borings were performed around the Fire Training Area to describe the site-specific lithology and to obtain soil samples. Petroleum based contamination was visually observed in combination with elevated hNu readings in one of the borings (09-5B-04), and the boring was abandoned. Soil samples from the remaining borings were screened for volatile contamination using a field gas chromatograph. Because of the field-screening results, eight soil samples (two samples from each of the remaining borings) were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

Three piezometers were installed surrounding the Fire Training Area to describe local groundwater flow direction and gradients.

2.1.8 SITE NO. 10--BULK CHEMICAL STORAGE AREA

Figure 2-8 shows the field-screening sample locations. An SOV survey was performed in the accessible areas surrounding the Bulk Chemical Storage Area. Five SOV sampling points were analyzed using a field gas chromatograph. Because of the results of the SOV survey, one soil boring was performed within the spill area of the Bulk Chemical Storage Area to describe the site-specific lithology and obtain soil samples. These samples were screened in the field using a gas chromatograph, and two samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

Three piezometers were installed around the site to estimate groundwater flow direction.

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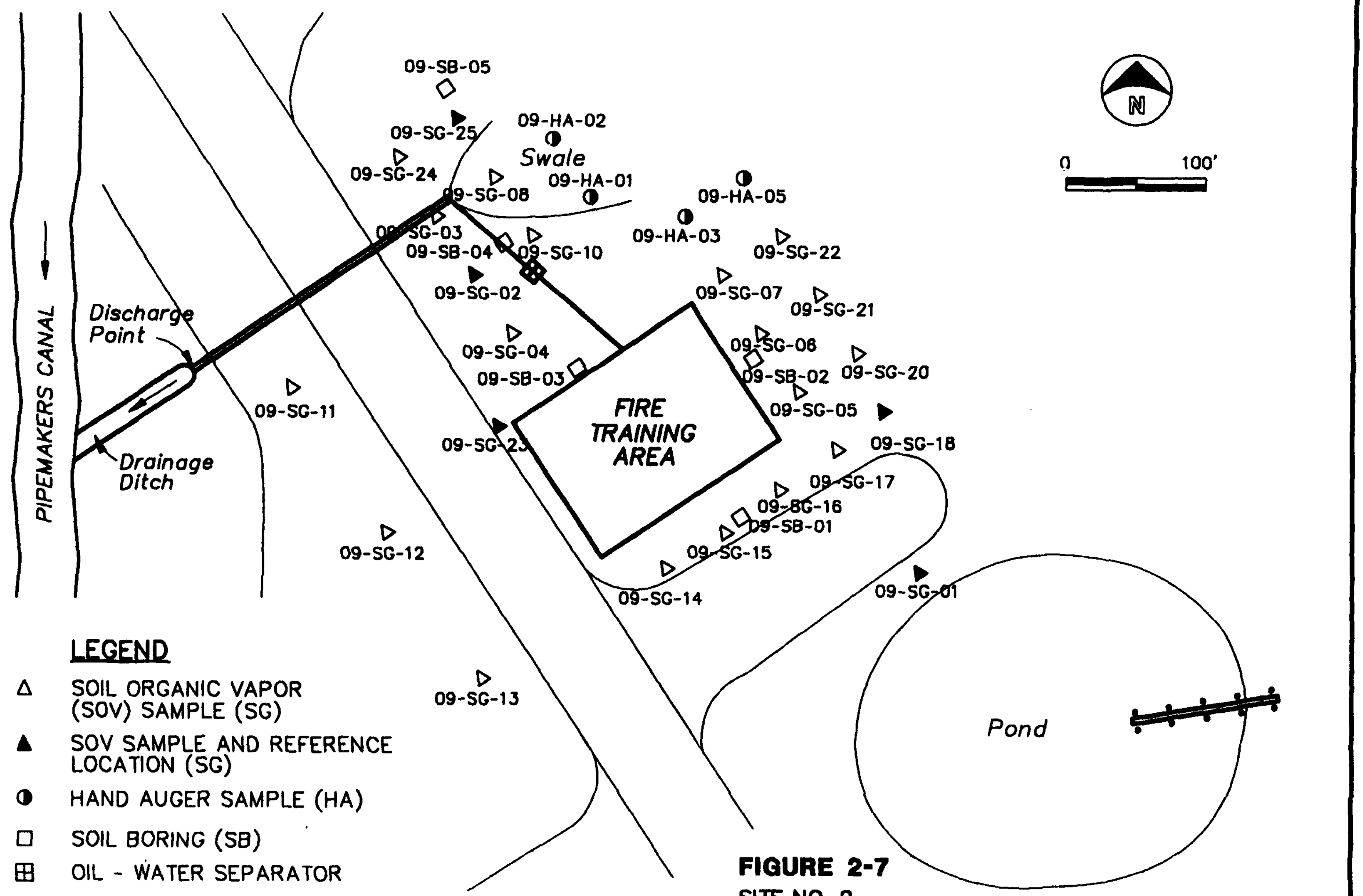

LEGEND

- △ SOIL ORGANIC VAPOR (SOV) SAMPLE (SG)
- ▲ SOV SAMPLE AND REFERENCE LOCATION (SG)
- ◐ HAND AUGER SAMPLE (HA)
- □ SOIL BORING (SB)
- ⊞ OIL - WATER SEPARATOR
- ⟶ FLOW DIRECTION

FIGURE 2-7
SITE NO. 9
165th CURRENT FIRE TRAINING AREA
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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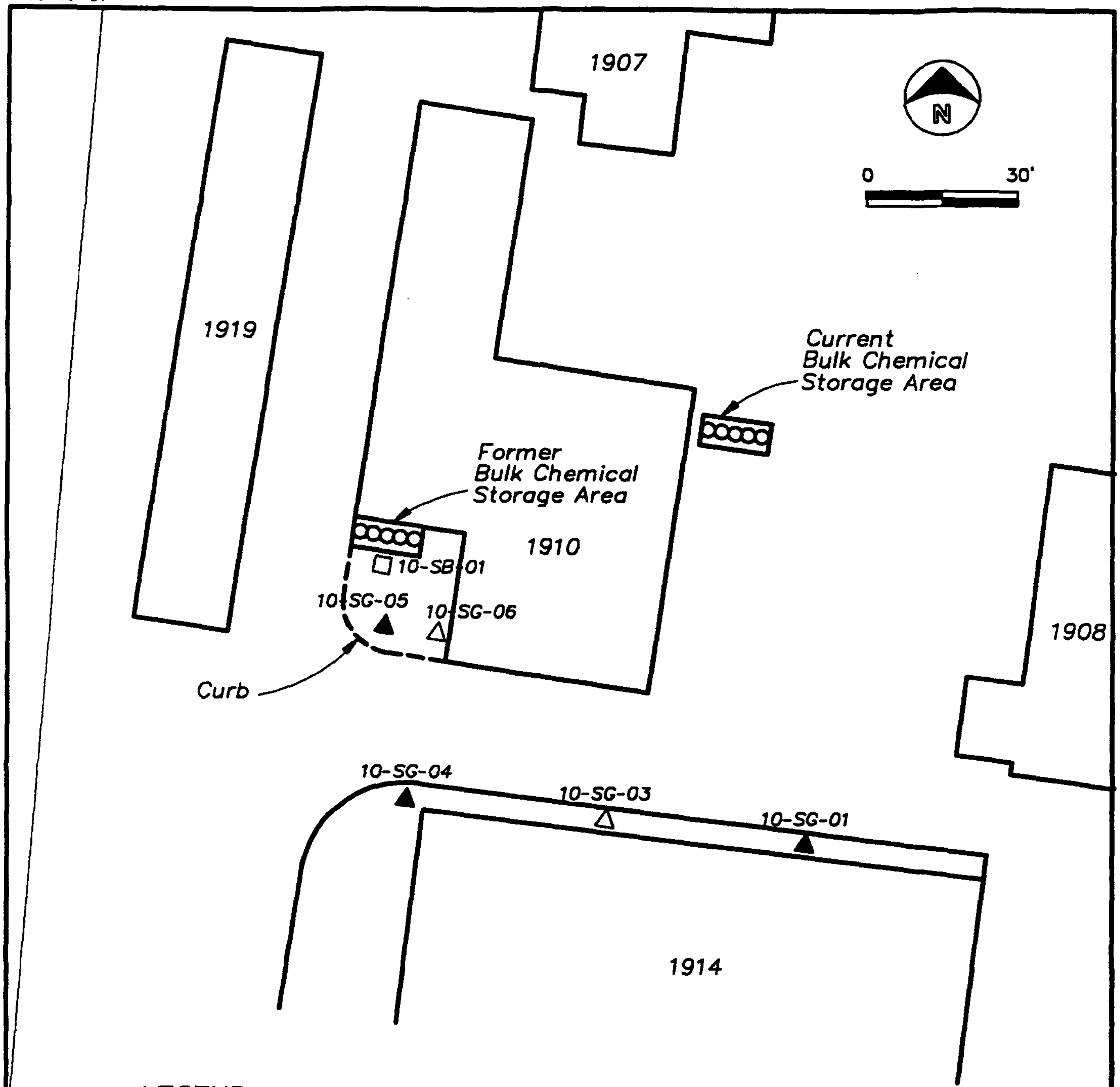

LEGEND

△ SOIL ORGANIC VAPOR (SOV) SAMPLE (SG)

▲ SOV SAMPLE AND REFERENCE STAKES (SG)

□ SOIL BORING (SB)

FIGURE 2-8

SITE NO. 10
165th BULK CHEMICAL STORAGE AREA
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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2.1.9 SITE NO. 11--OLD BURN AREA

Background data on Site No. 11 were available in Gulfstream's assessment report; however, CH2M HILL personnel performed a site assessment to become familiar with site conditions. Clearances for site access were obtained from Gulfstream Aerospace Corporation and coordinated with the 165th TAG Base Civil Engineer before field activities. Groundwater flow direction and gradients are described in Gulfstream's assessment report; therefore, no piezometers were installed at this site.

Figure 2-9 shows the field-screening sample locations for this site. Thirty SOV sampling points were analyzed using a field gas chromatograph. Because of the results of the SOV survey and the direction of groundwater flow at the site, two soil borings were performed downgradient of the anticipated contamination. These shallow soil borings were installed to describe the site-specific lithology and to obtain soil samples. Soil samples were screened for volatile contamination using a portable gas chromatograph, and two soil samples from each boring were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

2.2 CONFIRMATORY SAMPLING

The results of the first step of the SI, the field screening, were summarized in a technical memorandum that was submitted to HAZWRAP. Discussions were held to make appropriate modifications to the SI SAP for the next phase of the SI. Major field tasks in the second step of the SI, referred to as the confirmatory sampling, were installing monitor wells; sampling groundwater, surface water, and sediment; performing aquifer (slug) testing and top-of-casing surveys; and measuring water levels. The monitor well construction diagrams are contained in Appendix C.

2.2.1 SITE NO. 1--CRTC HANGAR AND WASHRACK DISCHARGE POINT

Figure 2-10 shows the confirmatory-sampling locations. Two shallow monitor wells were installed downgradient of areas of suspected contamination. The wells were installed at the water-table interface. A third well was planned at this site, but the well was not installed because the well boring indicated unfavorable soil conditions (highly plastic clay).

Groundwater samples were collected from each monitor well and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. An additional groundwater sample was collected, filtered, and sent to the laboratory for analysis of lead. Following the groundwater sampling, one slug test was performed to estimate hydraulic conductivity.

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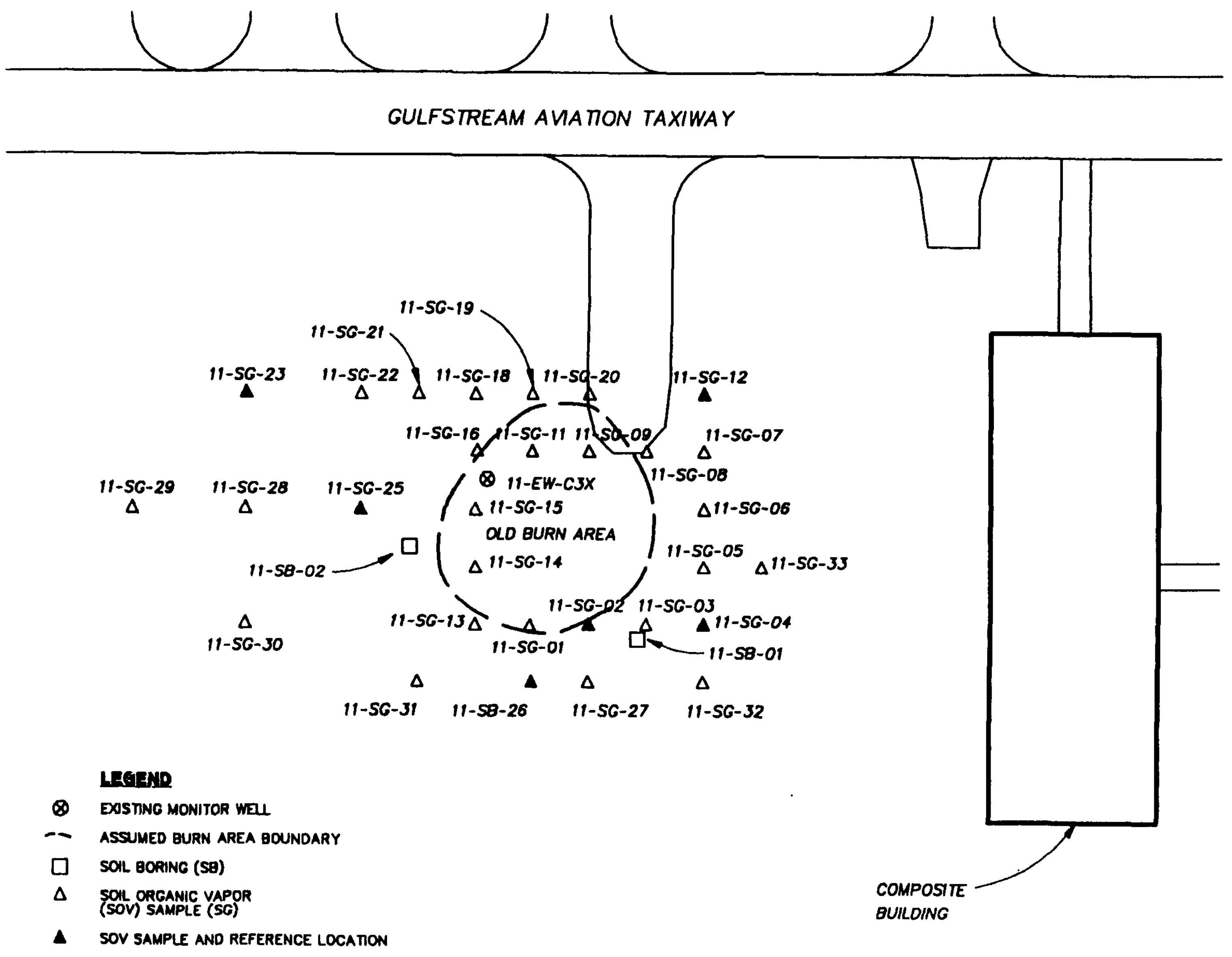

FIGURE 2-9
SITE NO. 11
165th OLD BURN AREA
FIELD-SCREENING SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2MHILL

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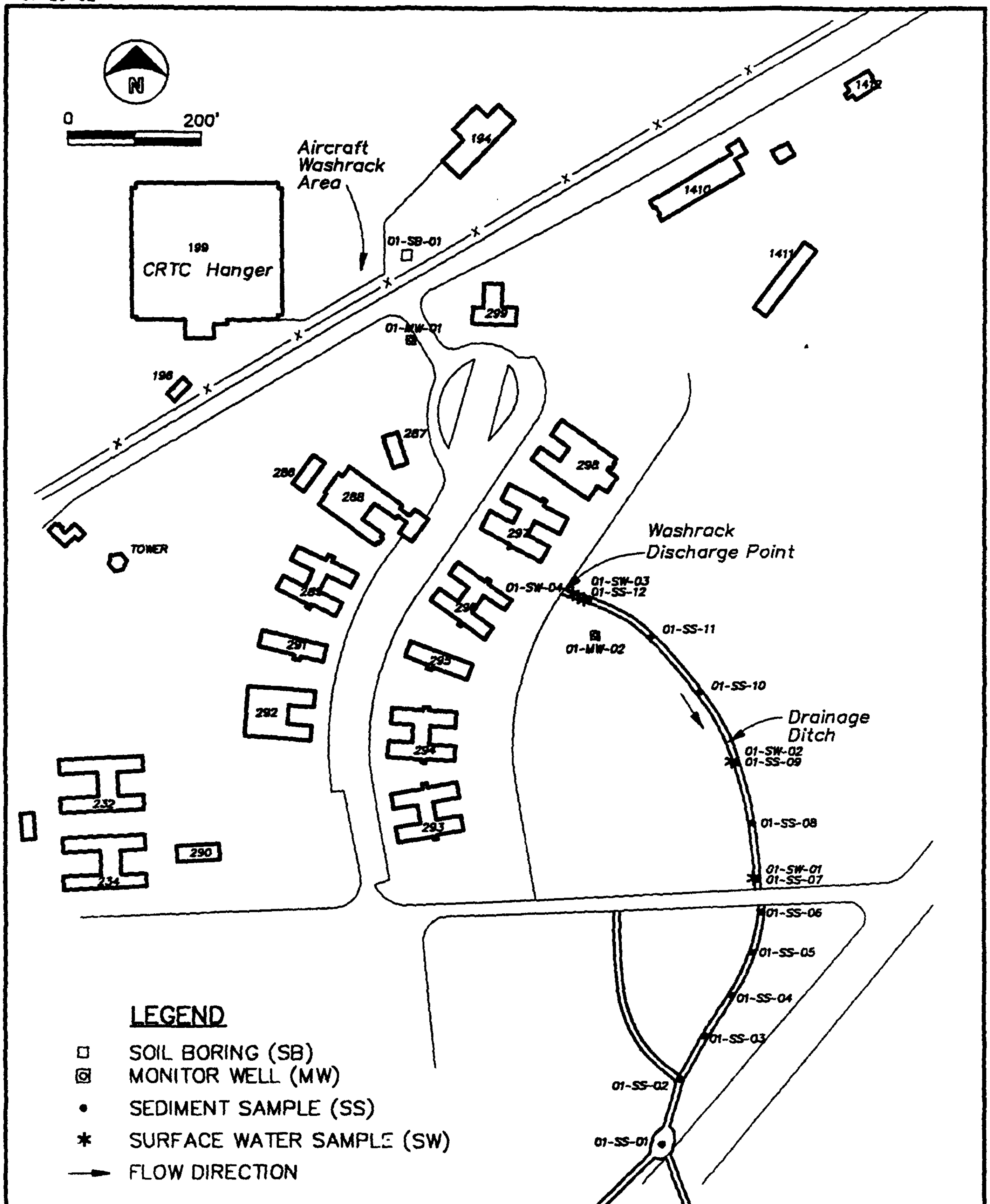

FIGURE 2-10
SITE NO. 1
CRTC HANGAR AND WASHRACK DISCHARGE POINT
CONFIRMATORY-SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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To evaluate the presence of residual contamination discharged from the washrack, four surface water samples were collected from the ditch at the discharge point and at distances approximately 50, 250, and 500 feet downstream from the point of discharge. Surface water samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. One additional sample was collected, filtered, and sent to the laboratory for analysis of lead.

Twelve sediment samples were collected along the receiving ditch and canal to investigate potential contaminant deposition. One sample was obtained from each location at depths of zero to 12 inches from the bottom of the ditch. The 12 samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. The portion of the sample to be analyzed for VOCs was discrete rather than part of a composite sample.

2.2.2 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

Figure 2-11 shows the confirmatory-sampling locations. One shallow monitor well was installed between the washrack and the oil-water separator, downgradient from contamination source. One groundwater sample was collected from the monitor well and sent to the laboratory for analysis of VOCs, PAH compounds, and TPH. Vertical data from the monitor well and drainage ditch were used to estimate groundwater and surface water elevations. Following the groundwater sampling, one slug test was performed on the monitor well to estimate hydraulic conductivity.

The drainage ditch was sampled to identify residual contamination. Two surface water samples were collected from the drainage ditch and sent to the laboratory for analysis of VOCs, PAH compounds, and TPH. The first sample was collected at the point of discharge, and the second sample was collected approximately 50 feet downstream from the point of discharge. A true up-stream surface water sample could not be obtained because the upstream ditch was dry.

Sediment samples from the receiving ditch were collected at the discharge point and at locations approximately 50, 100, and 200 feet downgradient from the discharge point. One sample was collected at each location from a depth of zero to 12 inches below the base of the ditch. Sediment samples were sent to the laboratory for analysis of VOCs, PAH compounds, and TPH.

2.2.3 SITE NO. 5--165TH BULK FUEL FACILITY

Figure 2-12 shows the confirmatory-sampling locations. Four shallow monitor wells were installed around the perimeter of the Bulk Fuel Facility. One groundwater sample was collected from each of the newly installed monitor wells and from one of the existing monitor wells. These samples were sent to the laboratory for analysis of

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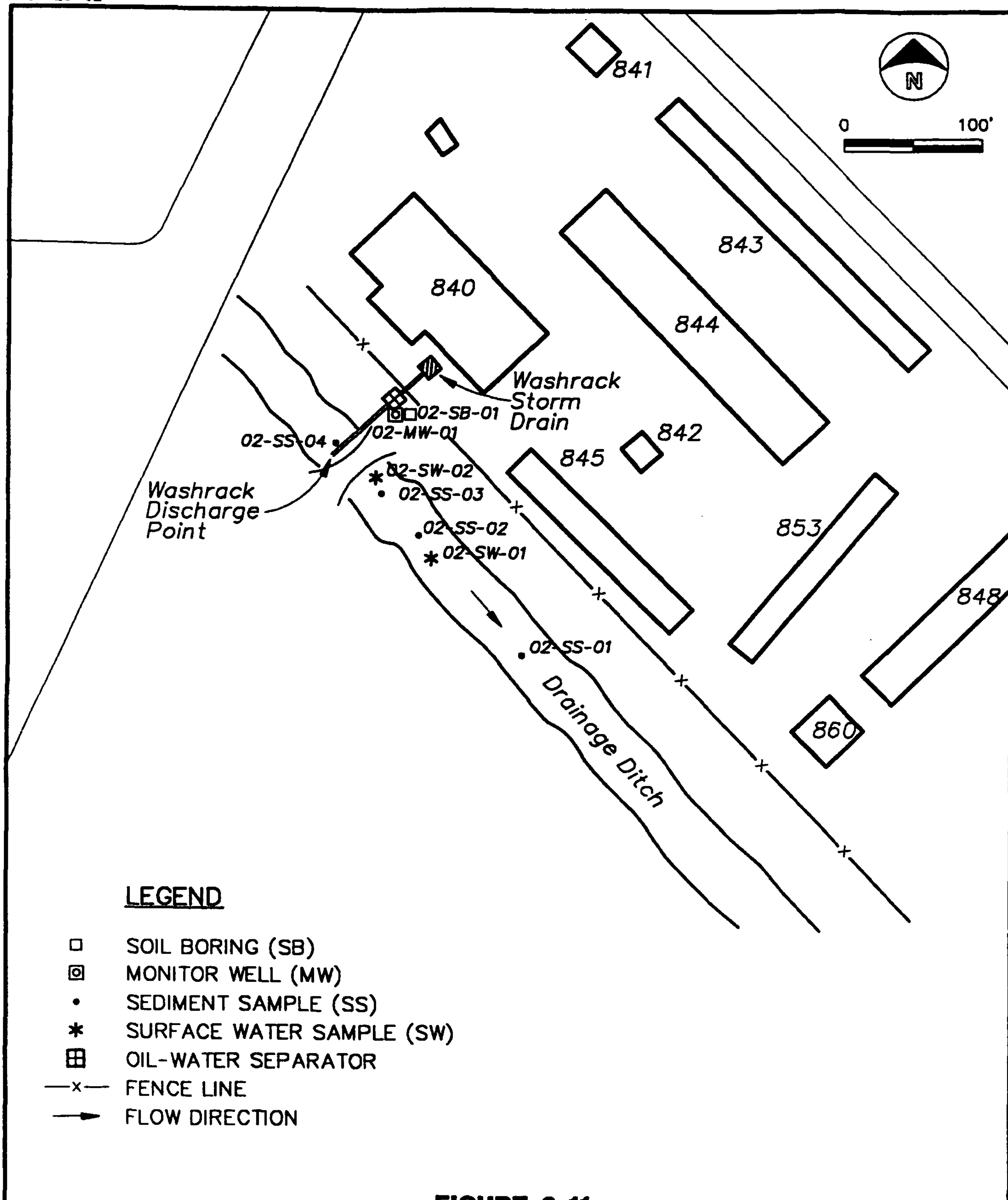

FIGURE 2-11

SITE NO. 2
CRTC VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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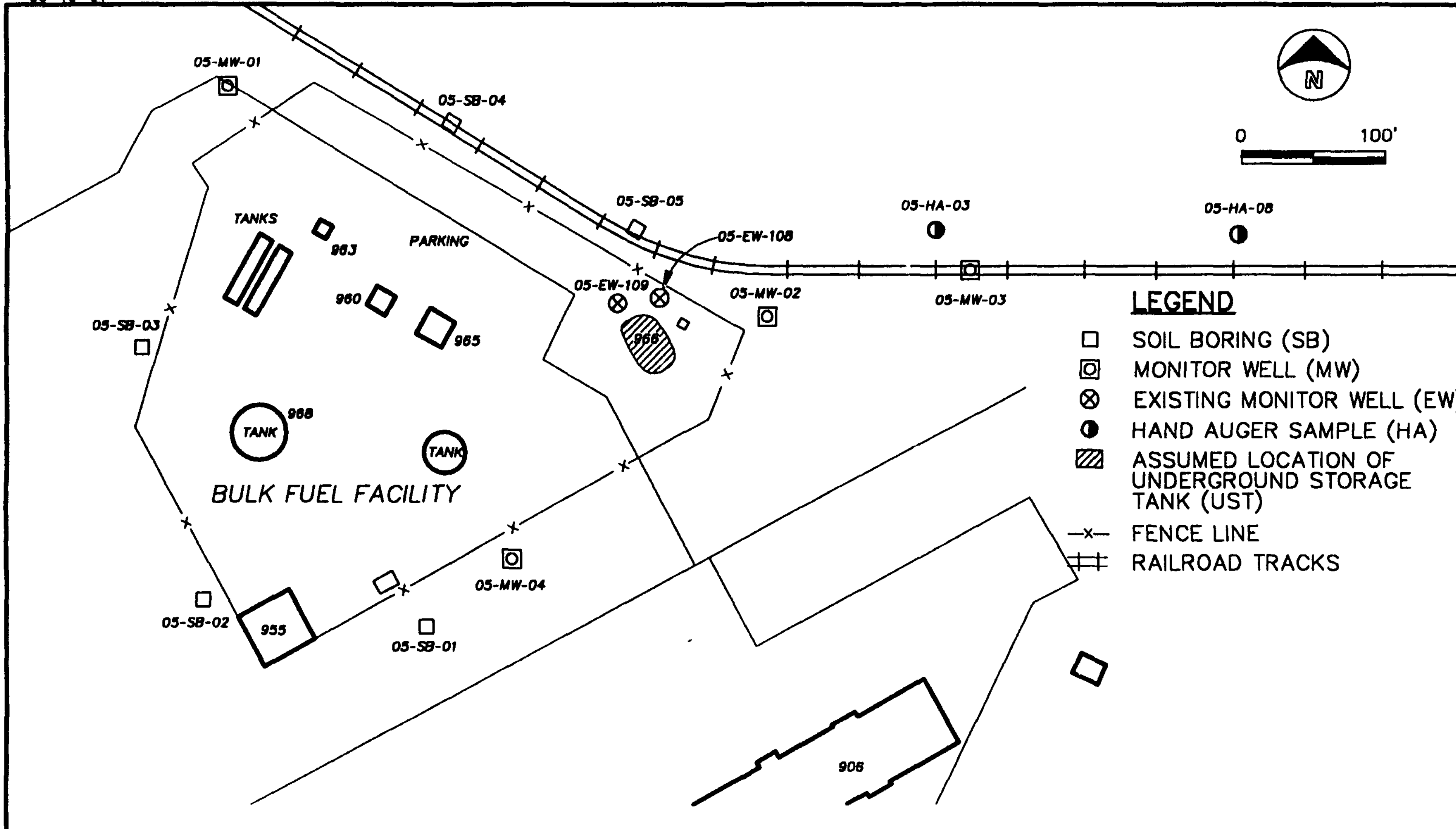

FIGURE 2-12

SITE NO. 5
165th BULK FUEL FACILITY
CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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VOCs, PAH compounds, TPH, and priority pollutant metals. Two additional groundwater samples were collected, filtered, and sent to the laboratory for analysis of lead. Following the groundwater sampling, one slug test was performed to estimate hydraulic conductivity.

2.2.4 SITE NO. 6--165TH VEHICLE MAINTENANCE SPILL AREA

Figure 2-13 shows the confirmatory-sampling locations. One shallow monitor well was installed downgradient of the suspected source of contamination. The monitor well was installed using a hand auger because access with a drilling rig was impractical. One groundwater sample was collected and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. An additional groundwater sample was collected, filtered, and sent to the laboratory for analysis of lead. Following the groundwater sampling, one slug test was performed in the monitoring well to estimate hydraulic conductivity.

2.2.5 SITE NO. 7--165TH VEHICLE MAINTENANCE WASHRACK

Figure 2-14 shows the confirmatory-sampling locations. One shallow monitor well was constructed downgradient of the washrack facility, and one groundwater sample was collected and sent to the laboratory for analysis of VOCs, PAH compounds, and TPH. Following collection of the groundwater sampling, a slug test was performed on the monitor well to estimate hydraulic conductivity.

Three surface water samples were collected from the ditch that had previously received the washrack discharge. Samples were collected upstream of the discharge point, at the discharge point, and at a point approximately 400 feet downgradient of the discharge point. The samples were sent to the laboratory for analysis of VOCs, PAH compounds, and TPH.

Sediment samples were also collected from the base of the drainage ditch at the discharge point and at locations approximately 50, 100, and 200 feet downgradient from the discharge point. At each sampling location, samples were obtained at a depth of zero to 12 inches below the base of the ditch. Sediment samples were sent to the laboratory for analysis of VOCs, PAH compounds, and TPH.

2.2.6 SITE NO. 8--OLD 165TH AIRCRAFT WASHRACK

Figure 2-15 shows the confirmatory sampling points. Four monitor wells were installed. One groundwater sample was collected from each monitor well and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. An additional sample was collected from one of the wells, filtered, and sent to the laboratory for analysis of lead. Following the completion of the groundwater

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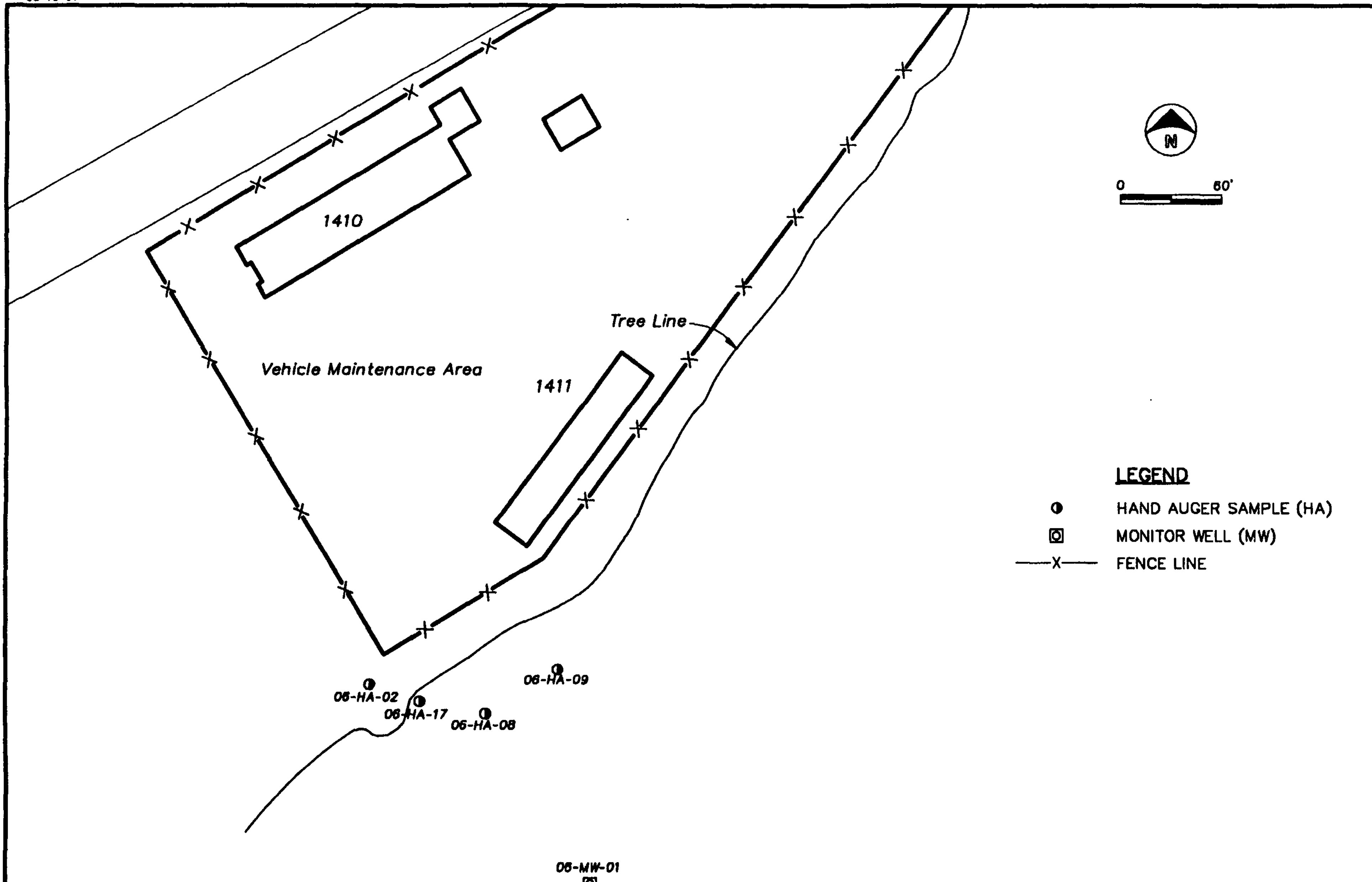

FIGURE 2-13

SITE NO. 6
165th VEHICLE
MAINTENANCE SPILL AREA
CONFIRMATORY-SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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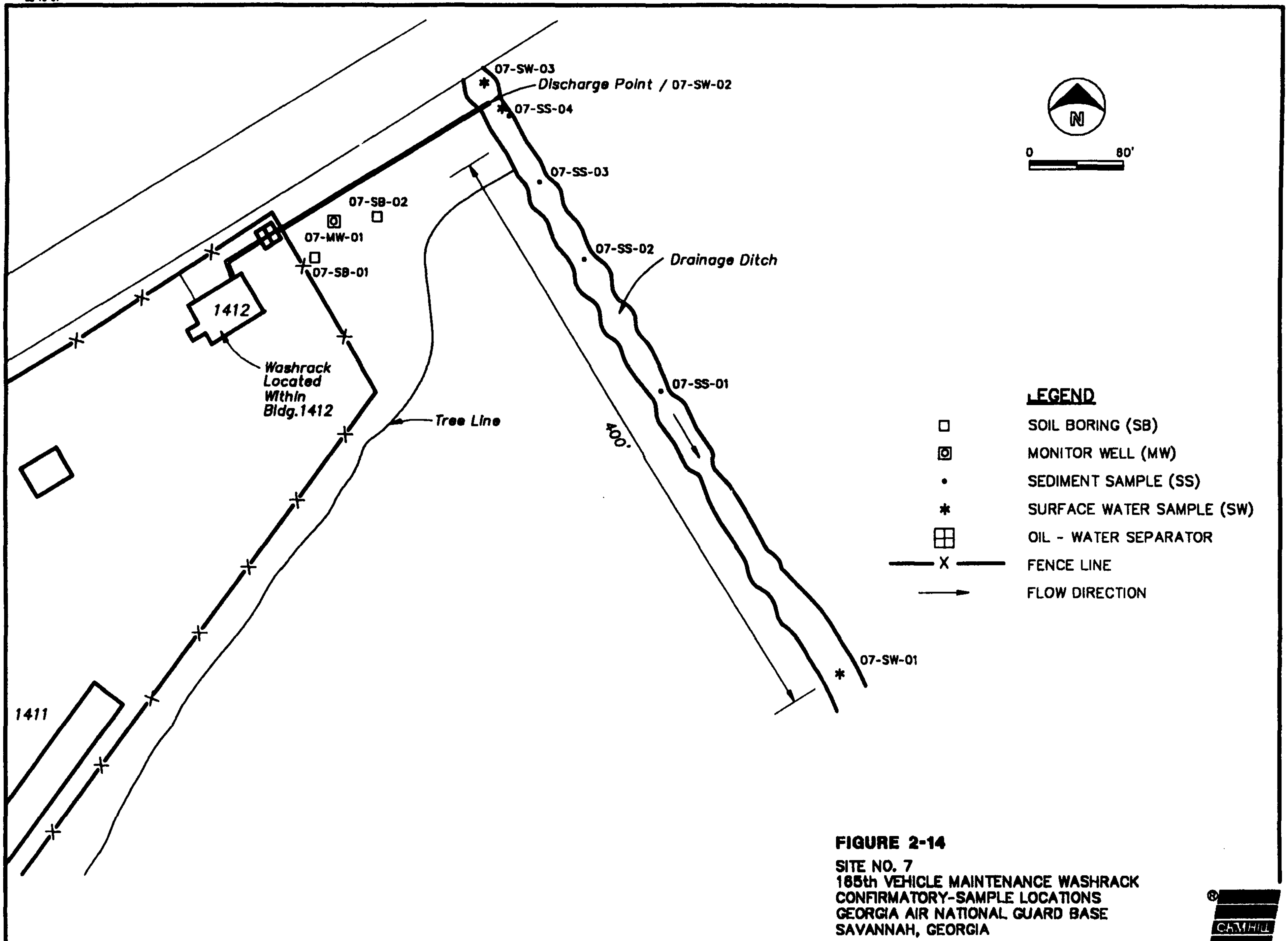

FIGURE 2-14

SITE NO. 7
165th VEHICLE MAINTENANCE WASHRACK
CONFIRMATORY-SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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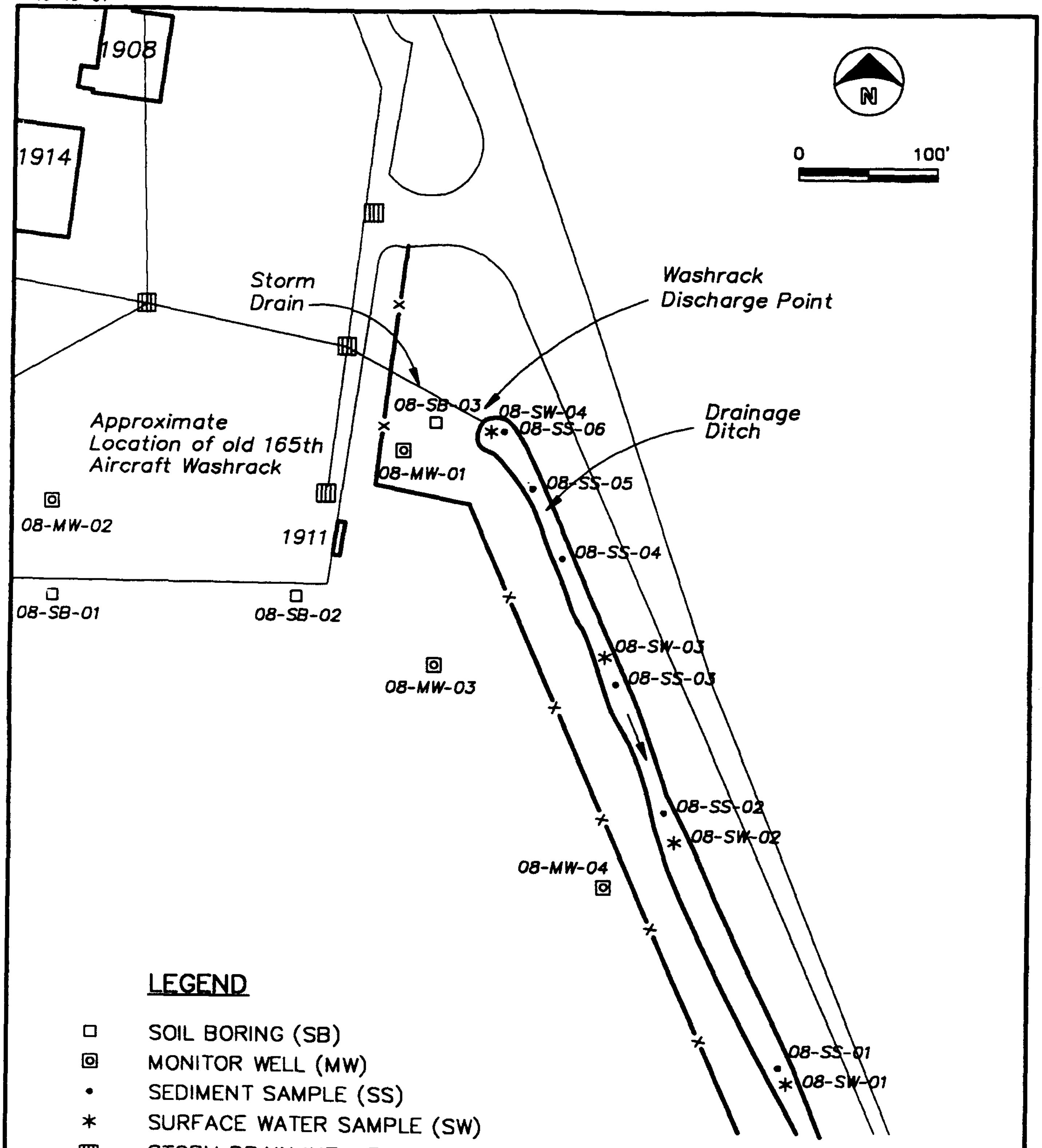

LEGEND

- □ SOIL BORING (SB)
- ⊡ MONITOR WELL (MW)
- • SEDIMENT SAMPLE (SS)
- * SURFACE WATER SAMPLE (SW)
- ▥ STORM DRAIN INTAKE
- —x— FENCE LINE
- ——▸ FLOW DIRECTION

FIGURE 2-15

SITE NO. 8
OLD 165th AIRCRAFT WASHRACK
CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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sampling, a slug test was performed on one of the monitor wells to estimate hydraulic conductivity.

The adjacent canal was sampled to evaluate residual contamination. Four surface water samples were collected: one at the discharge point, two at the location of groundwater seepage into the canal, and one approximately 500 feet downgradient from the discharge point. Samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. One additional sample was obtained, filtered, and sent to the laboratory for analysis of lead.

Sediment samples from the drainage canal were collected at the discharge point and at locations approximately 50, 100, 200, 300, and 500 feet downgradient from the point of discharge. At each location, samples were obtained at a depth of zero to 12 inches below the base of the canal. Sediment samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

2.2.7 SITE NO. 9--165TH CURRENT FIRE TRAINING AREA

Figure 2-16 shows the confirmatory-sampling locations. Five shallow monitor wells were installed downgradient from observed contamination. Although only four wells were originally planned for this site, a fifth well was added, substantially upgradient and north of the site, to serve as a background well. One groundwater sample was collected from each monitor well and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. One additional groundwater sample was collected, filtered, and sent to the laboratory for analysis of lead. Following the collection of the groundwater samples, a slug test was performed on one of the wells to estimate hydraulic conductivity.

At the point where the oil-water separator discharges into the ditch, a surface water sample was collected and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. One additional sample was collected from the same location, filtered, and sent to the laboratory for analysis of lead. A surface water sample was also collected from a small stormwater detention pond located south of the Fire Training Area and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

A sediment sample was collected from the point of discharge and sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals.

2.2.8 SITE NO. 10--BULK CHEMICAL STORAGE AREA

Figure 2-17 shows the confirmatory-sampling locations. One shallow monitor well was constructed downgradient of the site. One groundwater sample was collected and

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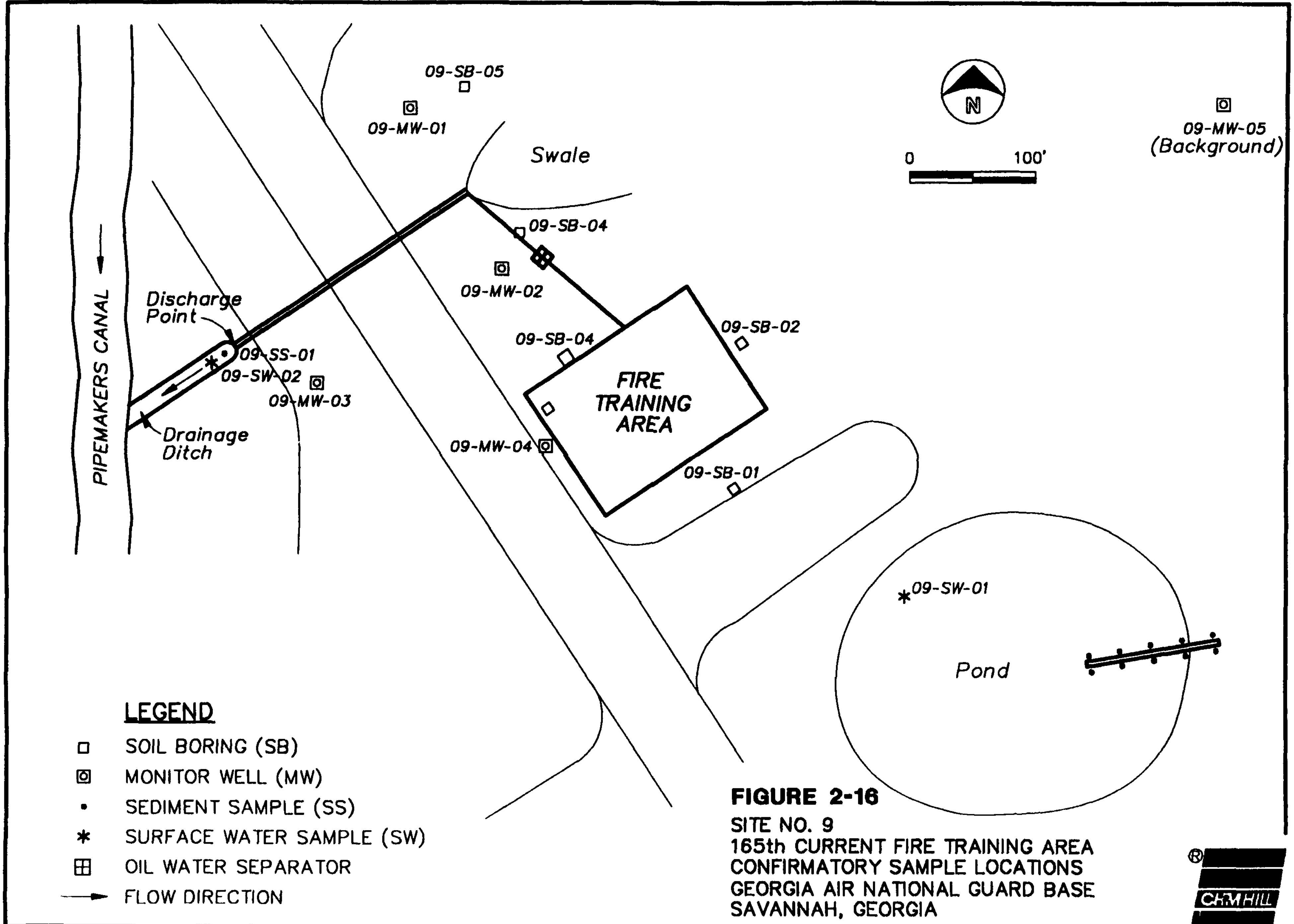

FIGURE 2-16
SITE NO. 9
165th CURRENT FIRE TRAINING AREA
CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL ®

F:\P_SMITH\05SITE9.DWG

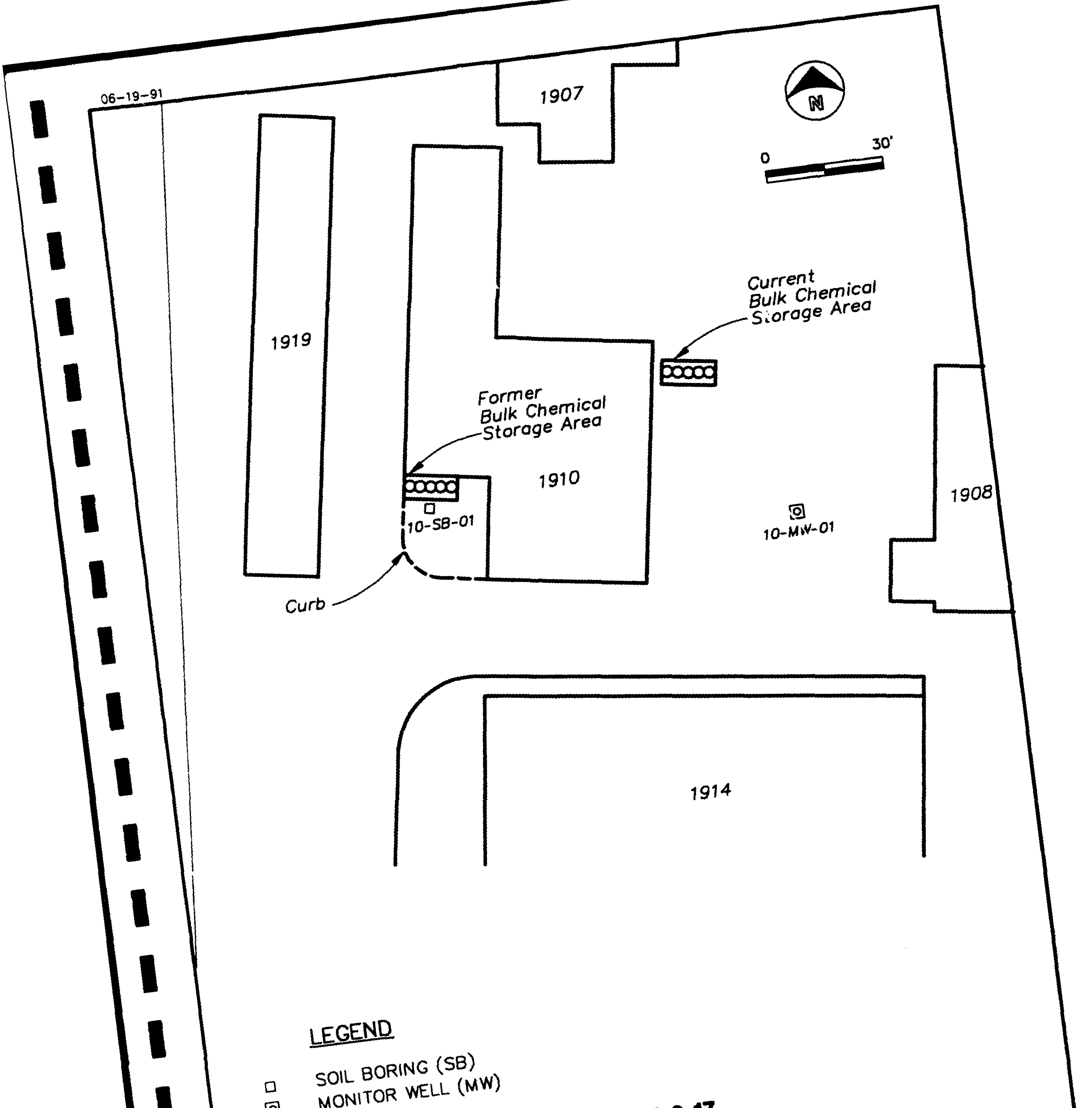

FIGURE 2-17

SITE NO. 10
165th BULK CHEMICAL STORAGE AREA
CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

sent to the laboratory for analysis of VOCs, PAH, TPH, lead (filtered sample), and priority pollutant metals. Following the collection of the groundwater sample, one slug test was performed on the monitor well to estimate aquifer characteristics.

2.2.9 SITE NO. 11--165TH OLD BURN AREA

Figure 2-18 shows the confirmatory-sampling locations. Three shallow monitor wells, approximately 20 feet bls, were installed near the Old Burn Area. Although only two wells were originally planned to be installed at this site, a third well was added to more fully decribe downgradient water quality. Groundwater samples were collected from each of the new wells and from the one existing well. Groundwater samples were sent to the laboratory for analysis of VOCs, PAH compounds, TPH, and priority pollutant metals. One additional sample was collected from one of the newly installed wells, filtered, and sent to the laboratory for analysis of lead. Following the collection of the groundwater samples, a slug test was performed on one of the newly installed wells to estimate hydraulic conductivity.

2.3 INVESTIGATION-DERIVED WASTE MANAGEMENT

Operations during the SI generated wastes such as drill and hand auger cuttings and water from decontamination procedures, sample purges, and well development. These wastes were disposed of in accordance with the *Site Investigation and Sampling Plan* (March 1990). Hand-auger cuttings were placed near the borings for use in backfilling. Used personal protective clothing was placed in plastic garbage bags and discarded in receptacles at GANGB.

Soil cuttings generated during monitor and piezometer well installation were screened using an hNu and placed in 55-gallon drums marked with the designation of the well from which the cuttings were generated. If all cuttings from a well installation appeared uncontaminated as measured by the hNu, these cuttings were discarded as clean material at the well location or at a location approved by the 165th TAG Base Civil Engineer. Drums containing contaminated soils, as indicated by the hNu photoionization detector (hNu), were transported by the drilling subcontractor to a designated location at GANGB. Composite samples were collected from each drum that contained wastes from a specific well location. The composite samples were analyzed for hazard characteristics and contaminant concentrations in accordance with Contract Laboratory Program guidelines. Appendix D contains a memorandum sent to GANGB describing the analytical results of the drilling cutting samples and a recommendation for disposal of the drill cuttings.

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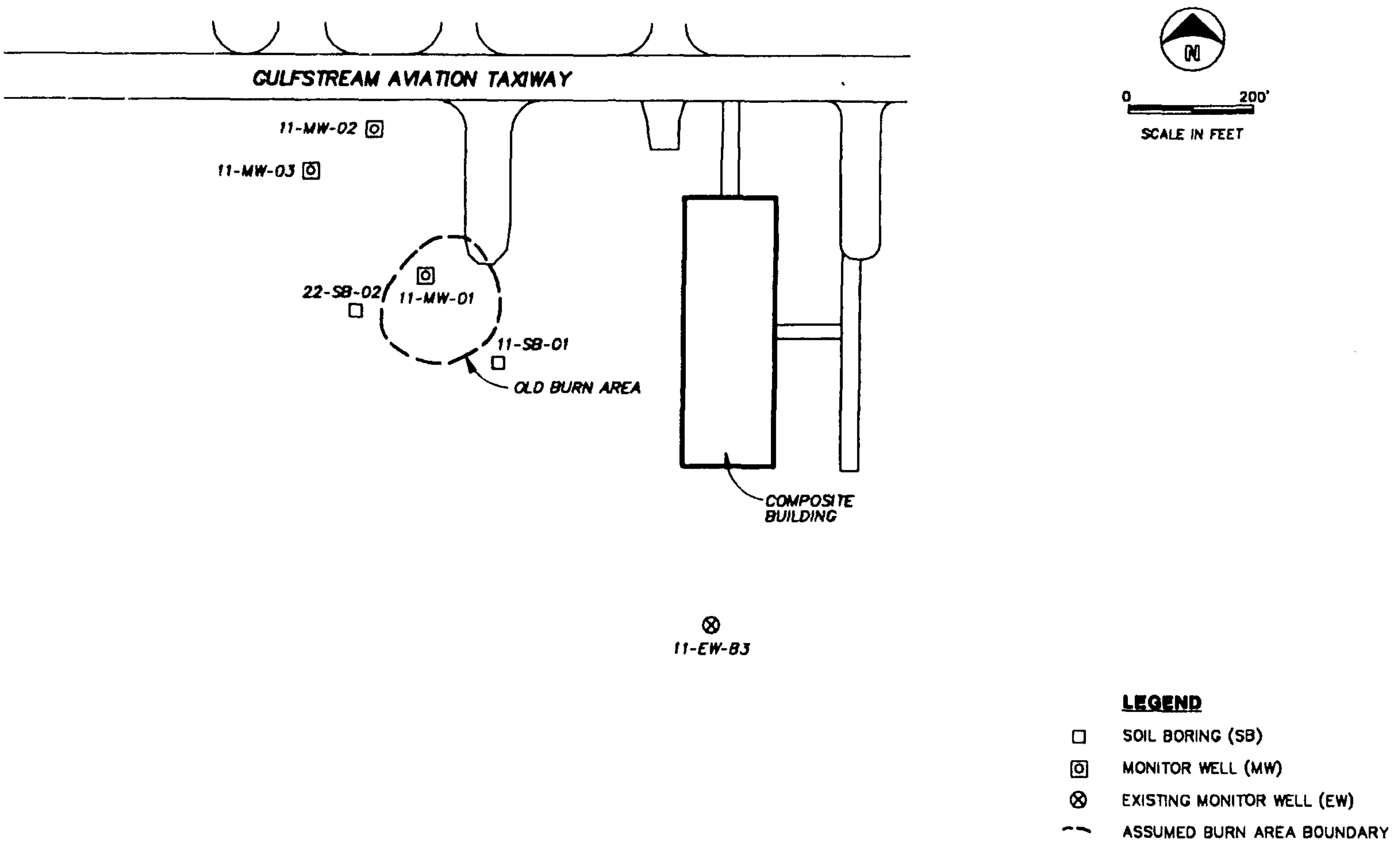

FIGURE 2-18

SITE NO. 11
185th OLD BURN AREA
CONFIRMATORY-SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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2.4 DEVIATIONS FROM THE SAMPLING PLAN

During the field activities associated with the SI, conditions described in the *Site Investigation Sampling and Analysis Plan* (March 1990), such as sampling procedures, proposed sampling locations, analytical parameters, and sample equipment and supplies, were used unless indicated in a field change request form (FCRF). During the SI, a total of 11 FCRFs were submitted to Martin Marietta Energy Systems. Copies of these FCRFs are in Appendix E. In addition to the FCRFs, three field surveillances were performed to evaluate whether field and lab quality assurance/quality control measures were implemented during the SI. These surveillance audits include an internal field audit conducted by CH2M HILL personnel at GANGB on September 14, 1990, and a review of the monthly laboratory progress reports and field surveillance audit performed by Martin Marietta Energy Systems personnel on September 20, 1990.

Section 3
DISCUSSION OF RESULTS

This section discusses the results of the following SI activities at the nine GANGB sites: hydrogeologic investigations, which included groundwater measurements and slug tests; field screening of soil samples; and laboratory analyses of soil, groundwater, surface water, and sediment samples. The results of these SI activities are presented by site so that each site can be evaluated independently. The review of the individual sites is followed by a discussion of the basewide geology and hydrology, the quality of soil and groundwater samples, and the quality control samples. The soil profiles from the field screening are in Appendix A. The methods used to interpret groundwater patterns and select monitor-well locations are described in a technical memorandum included in Appendix B. The slug-test methods are described in a technical memorandum included in Appendix F.

3.1 BACKGROUND SOIL AND GROUNDWATER QUALITY AND ACTION LEVELS

Background soil and groundwater samples were collected to identify baseline soil and water quality uninfluenced by the nine sites. Although background samples were not collected at each of the nine sites, several background locations were identified and sampled.

3.1.1 BACKGROUND GROUNDWATER QUALITY

Groundwater flow patterns at GANGB were documented through field measurements on July 13 and October 3, 1990. These measurements and the subsequent contour figures produced indicated that groundwater flows radially away from the topographic high of the base--the intersections of runways 27 and 36. Although the predominant regional flow pattern is to the east, the localized groundwater flow domain obscures this pattern. A true "upgradient" or background groundwater sample would therefore need to be collected at the center of the runways. Because this was impractical, a background well was installed northeast of Site No. 9. This well location (09-MW-05) appeared to be in an uninfluenced area and significantly upgradient of the activities performed at Site No. 9 and toward the topographic high of the Base. This location was agreed on by staff of Martin Marietta Energy Systems and CH2M HILL following a review of the field screening results.

The background well was sampled for VOCs, PAH compounds, TPH, and priority pollutant metals. The results of the background groundwater analyses are presented in data tables presented in this section for each site. The results indicated that the concentrations of VOC, PAH and TPH compounds were below detection limits.

Beryllium, cadmium, chromium, copper, lead, mercury, silver and zinc were observed above the detection limits.

3.1.2 BACKGROUND SOIL QUALITY

Although soil samples were not obtained from a designated background location, some samples were collected that may serve to evaluate background soil quality. Samples were collected from Soil Borings 05-SB-02 and 09-SB-01, which were both in upgradient locations to Site No. 5 and Site No. 9, respectively. Soil samples collected from these borings were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. Although the analyses did not detect any organic contaminants, several metals were detected in concentrations above their respective detection limits. In soil samples from Site No. 5, arsenic, chromium, copper, lead, nickel and zinc were detected at concentrations of approximately 2, 12, <1.2, 7, 4, and 7 mg/kg, respectively, while at Site No. 9 they were detected at concentrations of 4, 10, 2, 5, 6, and 3 mg/kg, respectively.

3.1.3 ACTION LEVELS

Potential action levels shown for each site were obtained from sources provided by GAEPD. In general, there are no action levels for soil and sediment. GAEPD has indicated that detections of contaminants should be compared to background. For groundwater, action levels have been obtained from Rules of Georgia Department of Natural Resources Environmental Protection Division, Chapter 391-3-5, Rules for Safe Drinking Water. For surface water, action levels have been obtained from Chapter 391-3-6, Water Quality Control. The instream concentrations have been shown as action levels at this time for comparison. Flow conditions of each surface water body have not been examined.

3.2 SITE NO. 1--CRTC HANGER AND WASHRACK DISCHARGE POINT

3.2.1 TOPOGRAPHY AND HYDROGEOLOGY

This site is in an area of GANGB that has a relatively large topographic gradient. The ground surface, which has been modified by filling activities, has a general topographic decline from north to south. Ground surface elevations are at a maximum, about 42 feet National Geodetic Vertical Datum (NGVD), at the hanger parking area, which is southeast of Building 199, and decrease to approximately 21 feet NGVD adjacent to the receiving ditch.

Approximately 50 percent of the area surrounding this site is covered with pavement and buildings, with the remaining land surface covered with maintained grass. The area is served by stormwater drains; however, the topography and a network of shal-

low stormwater ditches direct runoff into the drainage ditch, the discharge point for the washrack drain. From observations made during thundershowers and drilling activities, the surface soils appear moderately permeable and do not permit standing water even during heavy rainfall.

Stormwater is directed off the site by the drainage ditch. The ditch receives runoff and discharge from the washrack drain. The ditch ranges in width from 3 to 8 feet and in depth from 4 inches to over 2 feet. Although water has been observed to flow into the ditch at the discharge point, near stagnation occurs within 200 feet.

Soil profiles were prepared during the installation of the soil boring (01-SB-01) and the three well borings (01-WB-01, 01-WB-02, and 01-WB-03). In general, a surface layer of fine sand ranged in thickness from 2 to 9 feet bls. The surface soils were fine-grained, uncemented, moderately dense, and ranged in color from gray to yellowish tan. Fill material was apparent at several locations and was similar in properties to the native soil. Below the surface soils, a sandy clay layer was observed. Although the depth of the clay layer varied, the formation appeared to dip to the south, paralleling the topography. The clay layer varied from a sandy clay to a moderately stiff, plastic clay and ranged in color from greenish-gray to mottled tan and reddish gold. The clay was wet, if not saturated. By visual observation, the clay had a lower permeability than the overlying sands.

Groundwater flow at Site No. 1 was initially described using measurements recorded from four piezometers (01-PZ-01, 01-PZ-02, 01-PZ-03, and 01-PZ-04). A surface water elevation from the discharge point (01-SW-01) was also used in describing groundwater flow. According to measurements collected on July 13, 1990, the potentiometric surface in the upper sands is between a depth of approximately 3.5 to 12 feet bls. Groundwater movement was across the site to the southeast, intersecting the drainage ditch. This general flow pattern follows the topography and appears to have a fairly uniform gradient across the site. From the washrack area to the discharge point, an average gradient of 0.02 feet per foot to the southeast was estimated.

Following the installation of two monitor wells (01-MW-01 and 01-MW-02), a second round of water level measurements was performed on October 3, 1990. Figure 3-1 shows the contours produced from the second set of measurements. This figure also includes measurements from piezometers and monitor wells at Site No. 6 and Site No. 7. The contours confirm the earlier projections, with slightly more definition shown around the drainage ditch and washrack area. The average groundwater flow gradient remained approximately 0.02 feet per foot to the southeast.

On October 1, 1990, a slug test was performed in Monitor Well 01-MW-01. The test yielded a value of 11.85 feet per day (fpd) (4.18×10^{-3} centimeters per second [cm/s]) for hydraulic conductivity. This value appears consistent with the clean fine sands observed at the site and represents relatively good or moderate permeability. Using the observed hydraulic gradient of 0.02, the estimated hydraulic conductivity of

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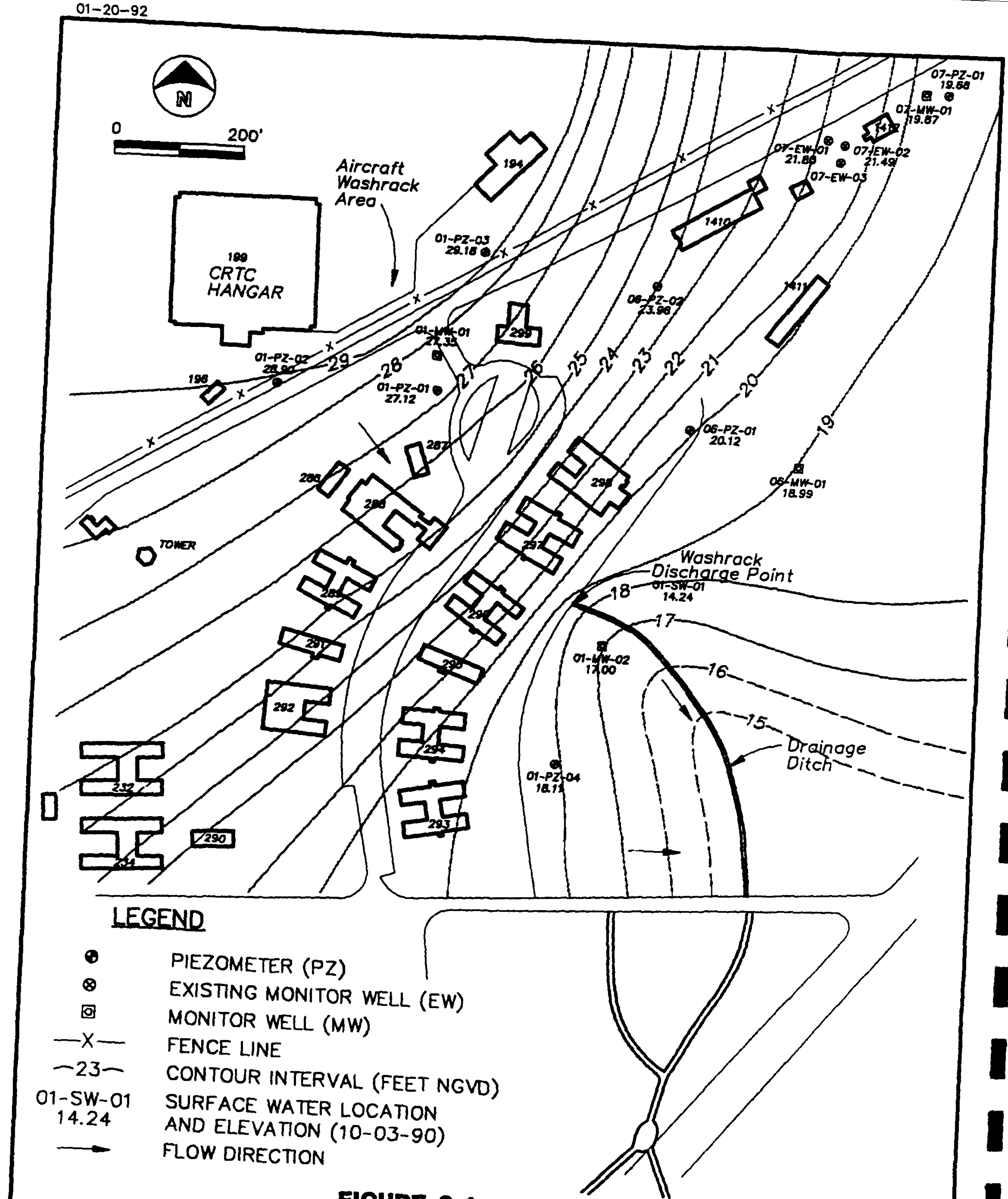

FIGURE 3-1

SITE NO. 1

CRTC HANGAR AND WASHRACK DISCHARGE POINT
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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11.85 fpd, and an assumed value for porosity of 0.40 (Hough, 1969), it was estimated that the average groundwater flow velocity at this site is about 0.60 feet/per day. clean, uniform (poorly graded) fine sands, porosity values typically range from 0.29 to 0.50 depending on degree of relative density. Based on this range, a median value of 0.40 was selected. (Holtz and Kovacs, 1981)

3.2.2 FIELD-SCREENING RESULTS

An SOV survey was performed in three locations at Site No. 1. Ten sampling points were collected to screen for five target compounds. Figure 2-1 shows the locations of these sampling points. Trichloroethene and toluene were detected in 7 of the 10 samples at concentrations ranging from 5 to 17 parts per billion (ppb). In sample 01-SG-03, total xylenes were detected at a concentration of 18 ppb. Although any reported value of these parameters constitutes a detection, the values are low for the method used and may be the result of fugitive vapors. While no measurements were made of air quality to confirm the impact on the SOV Survey, fuel odors were evident at various locations around the base. These could impact the results of field screening. The values were not significantly above values that may occur from background interferences. Because of the absence of a "hot spot", SOV was only marginally successful at Site No. 1.

As a result of the field-screening activities, there appeared to be no area of visual contamination in the upper soils at Site No. 1. A decision was then made to install one soil boring in the area adjacent to the washrack. This location was selected as the area of highest probability to detect contaminants that may have been released from the washrack.

During the installation of the soil boring, cuttings were screened using an hNu photoionization detector; no detections were observed. Samples were collected at 0 to 2 feet bls and 12 to 14 feet bls for head-space analysis using the field gas chromatograph. Trace quantities of toluene (16 ppb) were detected in both samples. The tracc quantities of contamination detected during the field screening could represent contamination in the soils at Site No. 1 or be an artifact introduced by the surrounding area, which is near airport operations.

3.2.3 LABORATORY ANALYSES RESULTS

Samples were collected for laboratory analyses from two depths at Soil Boring 01-SB-01 and from Monitor Wells 01-MW-01 and 01-MW-02. In addition, 4 surface water samples were collected from the drainage ditch, and 12 sediment samples were collected from the base of the drainage ditch. Samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. The laboratory results are shown in Tables 3-1A, 3-1B, 3-1C, 3-2A and 3-2B. These results and the locations of each of these sampling points is shown in Figure 3-2.

TABLE 3-1A
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT
SITE NO. 1 -CRTC HANGAR/WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM		TCE		Toluene		Naphthalene		2-Methyl Naphthalene		1-Methyl Naphthalene		Fluorene		Phenan-threne		Fluoran-thene		Pyrene	
I. Soil Boring Samples																				
01-SB-01 (0-2'bls)	1.[illegible]	U	1.0	U	1.3		51	U	51	U	51	U	51	U	51	U	51	U	51	U
01-SB-01 (12-14'bls)	1.2	U	1.2	U	1.2	U	60	U	60	U	60	U	60	U	60	U	60	U	60	U
Action Levels	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Background*	1.1	U	1.1	U	1.1	U	56	U	56	U	56	U	56	U	56	U	56	U	56	U
II. Sediment Samples																				
01-SS-01	18		1.4	U	1.4	U	370	U	370	U	370	U	370	U	880		1800		1800	
01-SS-02	15		1.3	U	1.3	U	67	U	67	U	67	U	67	U	67	U	67	U	67	U
01-SS-03	18		1.4	U	1.4	U	66	U	66	U	66	U	66	U	66	U	66	U	66	U
01-SS-04	28		1.2	U	1.2	U	65	U	65	U	65	U	65	U	65	U	53	J	38	J
01-SS-05	1.2	U	1.2	U	1.2	U	65	U	65	U	65	U	65	U	220		340		260	
01-SS-06	8.1	J	5.3		1.3	U	69	U	69	U	69	U	69	U	69	U	69	U	69	U
01-SS-07	7.6		1.3	U	1.3	U	71	U	71	U	71	U	71	U	71	U	71	U	71	U
01-SS-08	11	J	1.5	U	1.5	U	74	U	74	U	74	U	74	U	74	U	74	U	74	U
01-SS-09	1.9		1.9		1.2	U	600	U	600	U	600	U	600	U	3300		5200		4100	
01-SS-10	8.4	J	1.2	U	1.2	U	110	U	110	U	110	U	53	J	630		960		790	
01-SS-11	1.4	U	1.4	U	1.4	U	62	U	62	U	62	U	62	U	62	U	62	U	62	U
01-SS-12	8.2	J	1.2	U	1.2	U	1200	U	590	J	720	J	710	J	3300		4700		5400	
Action Levels	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Background*	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
DCM = Dichloromethane
TCE = Trichloroethene
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not available or applicable
Concentrations expressed as micrograms per kilograms (ug/kg)
* = Background soil values taken from Soil Boring 09-SB-01 (0-2'bls)

TABLE 3-1B
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT
SITE NO. 1 – CRTC HANGAR/WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) Pyrene	Ideno(1,2,3 -cd)pyrene	Dibenzo(a,h) anthracene	Benzo(g,h,i) perylene	TPH
I. Soil Boring Samples									
01-SB-01 (0-2'bls)	51 U	51 U	51 U	2 U	51 U	51 U	51 U	51 U	<1.7
01-SB-01 (12-14'bls)	60 U	60 U	60 U	2 U	60 U	60 U	60 U	60 U	<2.0
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	13.1
II. Sediment Samples									
01-SS-01	930	1200	760	480	940	630	370 U	430	49.4
01-SS-02	67 U	67 U	67 U	67 U	67 U	67 U	67 U	67 U	9.3
01-SS-03	66 U	66 U	66 U	66 U	66 U	66 U	66 U	66 U	<2.2
01-SS-04	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	6.8
01-SS-05	110	180	86	55 J	140	130	74	91	6.1
01-SS-06	69 U	69 U	69 U	69 U	69 U	69 U	69 U	69 U	<2.2
01-SS-07	71 U	71 U	71 U	71 U	71 U	71 U	71 U	71 U	3.0
01-SS-08	74 U	74 U	74 U	74 U	74 U	74 U	74 U	74 U	<2.4
01-SS-09	1500	2900	1500	950	2000	2800	920	2000	132
01-SS-10	300	600	310	190	460	480	150	380	58.7
01-SS-11	62 U	62 U	62 U	62 U	62 U	62 U	62 U	62 U	<2.1
01-SS-12	1500	3600	1500	890 J	2000	1600	610 J	1100 J	96.1
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
TPH = Total Petroleum Hydrocarbon
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per kilograms (ug/kg), except for TPH.
Concentrations for TPH expressed as milligrams per kilogram (mg/kg) for soil samples.
* = Background soil value taken from Soil Boring 09-SB-01 (0-2'bls)

TABLE 3-1C
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 1 - CRTC HANGAR/WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	DCM		TPH
I.	Groundwater Samples			
	01-MW-01	1.0	U	<0.05
	01-MW-02	1.0	U	0.06
	Action Levels	NA		NA
	Background*	1.0	U	<0.06
II.	Surface Water Samples			
	01-SW-01	1.0	U	<0.05
	01-SW-02	1.0	U	<0.06
	01-SW-03	1.0	U	<0.05
	01-SW-04	1.7		<0.05
	Action Levels	1578		NA
	Background*	NA		NA

Notes:
bls = Below Land Surface
MW = Monitor Well
SW = Surface Water
DCM = Dichloromethane
TCE = Trichloroethene
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per liter (ug/l), except for TPH
Concentrations for TPH expressed as millgrams per liter (mg/l)
* = Background groundwater values taken from monitor well 09-MW-05

TABLE 3-2A
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR SOIL/SEDIMENT
SITE NO. 1 – CRTC HANGAR/WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic		Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
I. Soil Boring Samples											
01-SB-01 (0-2'bls)	<0.51	J	<0.51	<0.51	3.6	<1.0	3.1	<0.02	<2.6	<1.0	1.0
01-SB-01 (12-14'bls)	<0.60	J	<0.60	<0.60	12.0	<1.2	9.0	<0.02	4.2	<1.2	6.6
Action Level	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	4.00		<0.56	<0.56	15.6	<1.1	3.9	<0.02	<2.8	<1.1	<3.9
II. Sediment Samples											
01-SS-01	3.8	J	0.81	0.34	13.6	2.7	32.3	<0.03	<5.4	<1.3	36.3
01-SS-02	9.5	J	1.3	<0.03	12.3	<2.6	7.4	<0.03	<5.3	<1.3	9.3
01-SS-03	1.2	J	1.3	<0.03	14.2	<2.6	8.9	<0.02	<5.3	<1.3	7.9
01-SS-04	0.89	J	1.3	0.03	21.6	<2.6	10.7	<0.03	<5.1	<1.3	12.8
01-SS-05	<0.65	R	<0.65	<0.03	15.4	<2.6	9.8	<0.03	<5.2	<1.3	13.1
01-SS-06	11.2	J	1.1	<0.03	31.0	2.8	13.3	<0.03	<5.6	<1.4	15.4
01-SS-07	1.4	J	0.84	<0.03	21.8	<2.8	11.4	<0.03	<5.6	<1.4	7.0
01-SS-08	<0.70	R	<0.70	<0.03	30.2	2.8	14.2	0.03	<5.6	<1.4	19.7
01-SS-09	2.4	J	<0.60	0.36	8.4	6.0	26.7	0.23	<4.8	<1.2	13.2
01-SS-10	17.0	J	<0.57	0.14	7.0	10.2	17.2	0.02	<4.5	<1.1	24.9
01-SS-11	1.3	J	0.64	<0.03	2.2	<2.6	24.1	<0.03	<4.9	<1.2	57.3
01-SS-12	10.5	J	<0.61	2.9	29.8	4.9	79.6	0.04	<4.9	<1.2	57.3
Action Level	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	7.4		0.85	1.7	52	22	17	0.12	18	NA	52

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
R = Quality control indicates that data is not usable.
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not available or applicable
Antimony and Thallium were tested for, but neither was detected.
Concentrations are milligrams per liter (mg/l).
* = *Background soil value taken from soil boring 09-SB-01 (0-2' bls). Background sediment values taken from U.S. Geological Survey (1984).*

TABLE 3-2B
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 1 - CRTC HANGAR/WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Groundwater Samples											
01-MW-01	<0.005	<0.005	<0.0002	0.011	<0.02	NS	0.009	<0.0002	<0.04	<0.01	0.01
01-MW-02	<0.005 J	<0.005	0.0005	0.036 J	<0.02	<0.002 J	0.023 J	<0.0002	<0.04	0.03	0.06
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.050	0.002	NA	0.050	NA
Background*	0.005	0.012	0.0005	0.074	.06	NS	0.022	0.0003	<0.04	0.011	0.08
II. *Surface Water Samples*											
01-SW-01	<0.005	<0.005	0.0002	<0.002	<0.02	NS	<0.002	<0.0002	<0.04	<0.01	0.01
01-SW-02	<0.005	<0.005	0.0003	<0.002	<0.02	NS	<0.002	<0.0002	<0.04	<0.01	0.01
01-SW-03	<0.005	<0.005	<0.0002	<0.002	<0.02	<0.002	<0.002	<0.0002	<0.04	<0.01	<0.01
01-SW-04	0.006	<0.005	<0.0002	<0.002	<0.02	NS	<0.002	<0.0002	<0.04	<0.01	<0.01
Surface Water Standards	0.050	0.001	0.0011	0.210	0.012	NA	0.0032	0.00001	0.160	0.00012	0.110
Background*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
bls = Below Land Surface
MW = Monitor Well
SW = Surface Water
F = Filtered sample
UF = Unfiltered sample
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
Antimony and Thallium were tested for, but neither was detected.
Concentrations are milligrams per liter(mg/l).
* = Background groundwater values taken from monitor well 09-MW-05

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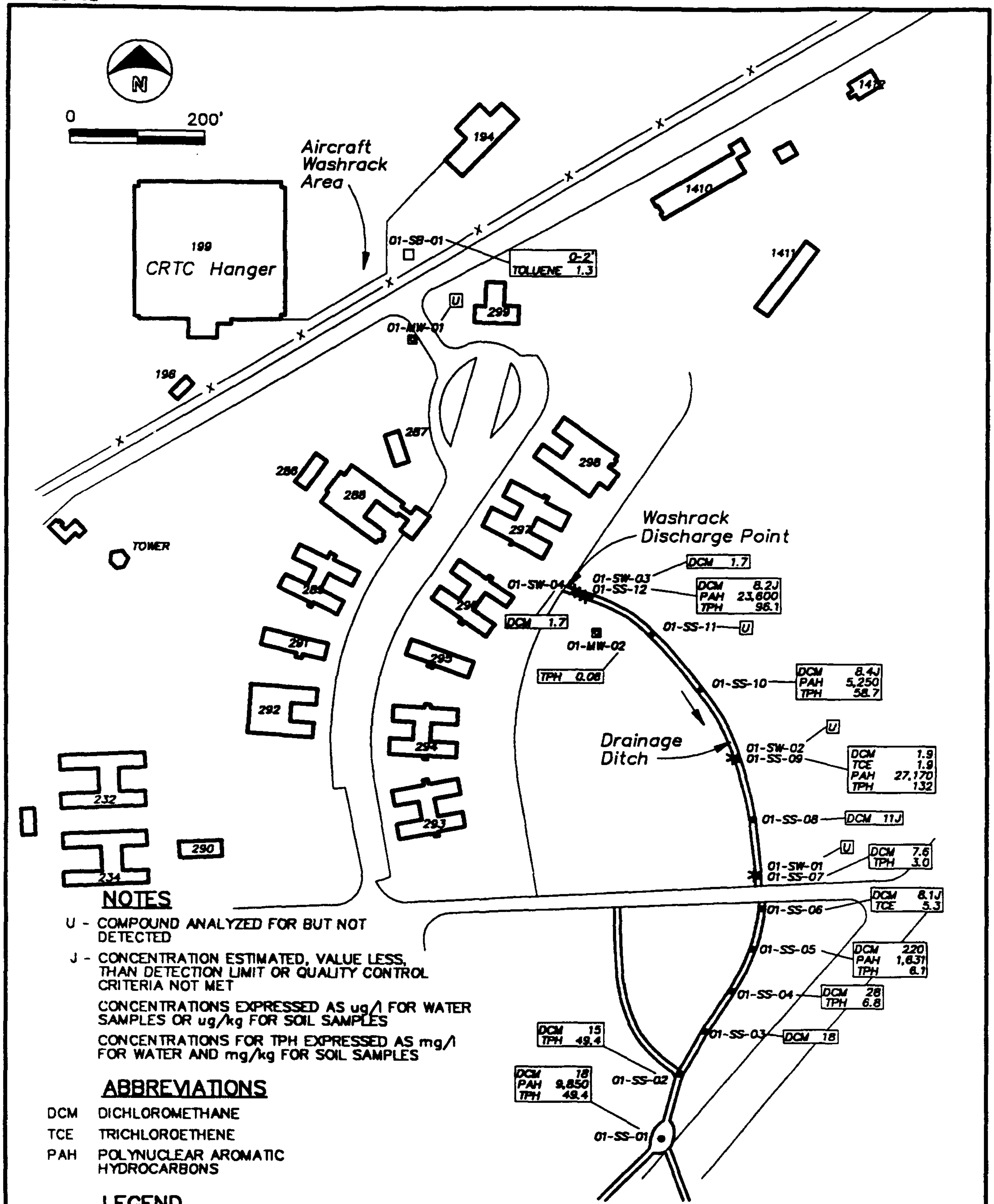

NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM DICHLOROMETHANE

TCE TRICHLOROETHENE

PAH POLYNUCLEAR AROMATIC HYDROCARBONS

LEGEND

□ SOIL BORING (SB)

MONITOR WELL (MW)

• SEDIMENT SAMPLE (SS)

* SURFACE WATER SAMPLE (SW)

→ FLOW DIRECTION

FIGURE 3-2

SITE NO. 1

CRTC HANGAR AND WASHRACK DISCHARGE POINT CONFIRMATORY SAMPLE ORGANIC RESULTS

GEORGIA AIR NATIONAL GUARD BASE

SAVANNAH, GEORGIA

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The samples from the soil boring were collected from 0 to 2 feet bls and from 12 to 14 feet bls. Samples analyzed for VOCs were taken as discrete samples, collected within thin-walled sampling tubes, and samples analyzed for TPH, PAH compounds, and priority pollutant metals were composited from the remaining material. Toluene was detected in the shallow soil samples at 1.3 µg/kg. The analytical results for the soil samples also indicated miscellaneous metals at low concentrations. Chromium, lead, nickel, and zinc were detected at levels above method detection limits.

In the groundwater samples, organic compounds were detected at concentrations below method detection levels, except TPH, which was detected at 0.06 mg/l in Monitor Well 01-MW-02. Some metals (arsenic, cadmium, chromium, lead, silver, and zinc) were detected at concentrations ranging from 0.5 to 60 µg/l. Lead was detected at 23 µg/l in an unfiltered sample from Monitor Well 01-MW-02; however, the concentration was less than the detection limit when the sample was filtered through a 0.45-micron filter.

The results of the analyses of the surface water samples indicated all organic compounds analyzed (VOCs, PAH compounds, and TPH) were below method detection limits, except dichloromethane, which was detected at 1.7 µg/l in sample 01-SW-04. Dichloromethane (methylene chloride) is a common laboratory contaminant because of its widespread use in sample extraction. Trace quantities of some priority pollutant metals were detected in the surface water samples. Arsenic, cadmium, and zinc were detected at concentrations slightly above the method detection limits.

Analytical results for the sediment samples collected along the drainage ditch indicated that VOCs, PAH compounds, TPH, and metals were detected at elevated levels at some locations. Samples with the highest levels were collected from the discharge point and next to the roads, which may indicate that discharge from the washrack drain has influenced contaminant levels in sediments within the ditch. However, from the results, it appears that road runoff from Bob Harman and Dean Forest Roads may also be contributing to contamination within the sediments.

3.2.4 SUMMARY

It appears that there are two areas that contain contamination at detectable levels. The first area is around the washrack pavement where a low level of toluene was detected in the upper soils, approximately 0 to 3 feet bls. Because this site is next to roads and the runway, roadwash or jet engine emissions could accumulate in this area, causing the levels of toluene detected.

The second area of contamination is in the sediments along the drainage ditch where VOCs, PAH compounds, and TPH were detected. The presence of these compounds may be attributable to discharges from the washrack and/or stormwater runoff from the adjacent roads.

3.3 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

3.3.1 TOPOGRAPHY AND HYDROGEOLOGY

This site is in a relatively low-lying and flat area. The elevation of most of the site is approximately 13 feet NGVD, with a gradual incline to the southeast. The surrounding areas are almost entirely paved. Stormwater is managed by a series of drains that collect and channel the water into a drainage ditch on the southwest side of the site. The drain that collects washwater from the washrack also collects stormwater from a drainage area of several hundred square feet.

The drainage ditch begins at Dean Forest Road and continues to the southeast. At the intersection of Mikell Avenue, approximately 200 yards southeast of the site, the drainage ditch intersects other drainage ditches flowing from three directions. During periods of "no-flow," a stagnation pond forms at the intersection of the ditch and Mikell Avenue where stormwater appears to pool and evaporate or percolate into the ground. During heavy thundershowers, stormwater continues to travel in the ditch, which flows southeast past Mikell Avenue, and enters a secondary drainage ditch that flows east, ultimately discharging into the Pipemakers Canal.

During the SI, the drainage ditch averaged approximately 3 feet in width and varied in depth from 3 inches by the site to approximately 12 inches at the intersection of Mikell Avenue. There was little or no water in the ditch upstream, northwest of the site.

Two borings (Soil Boring 02-SB-01 and Well Boring 02-WB-01) were performed at the site. In the soil profiles from these borings, the upper two feet of material consisted of a dark grayish brown fine sand that appeared to be fill material. From 2 to 8 feet bls, there was a gray to gray and gold clayey sand layer (non-plastic), which contained the groundwater surface. Although the clayey material appeared to be less permeable than the overlying sands, its permeability was sufficient to transmit groundwater. From 8 to 11 feet bls, an olive gray sand layer was encountered. Although the sand had slight traces of silt and clay, it appeared to have a higher permeability than the clayey sand layer. Below 11 feet bls, a very fine sandy clay was encountered. This formation's permeability appeared to be lower than that of the overlying formations.

Because the direction of groundwater flow could be inferred at this site, no piezometers were installed. Groundwater contours were prepared by extrapolating data from a surface water elevation (02-SW-01) measured at Site No. 2 and from groundwater measurements for Site No. 5, which is approximately 200 yards to the east-southeast. Based on data collected July 13, 1990, a generally southeasterly groundwater-flow pattern was observed. The groundwater surface was identified at approximately 6 feet bls during the installation of Soil Boring 02-SB-01.

Following the installation of Monitor Well 02-MW-01, a second set of water level measurements was collected on October 3, 1990. Contours were prepared using these measurements and the measurements from Site No. 5. These contours are shown in Figure 3-3. The contours for October 3, 1990, indicate a groundwater flow gradient of about 0.004 feet per foot to the east.

On October 1, 1990, a slug test was performed in Monitor Well 02-MW-01. The test was performed as a "slug-out" or recovery test and yielded a hydraulic conductivity *value of 3.54 fpd (1.25 x 10^{-3} cm/s). This value is consistent for fine sands and* probably reflects a composite value for the clayey-sand layer, located between 4 and 8 feet bls, and the sand layer, located between 8 and 11 feet bls. Using the observed hydraulic gradient of 0.004, the estimated hydraulic conductivity of 3.54 ftd, and an assumed value of porosity of 0.40, it was estimated that groundwater flows across Site No. 2 to the east at an average velocity of 0.035 fpd.

3.3.2 FIELD-SCREENING RESULTS

Field-screening activities at Site No. 2 included hNu screening of soil samples collected from Soil Boring 02-SB-01. The location of this sample is shown in Figure 2-2. The hNu readings were averaged over the 24 inches of each sample and were reported in the soil boring log. The hNu readings were below detection limits (1 ppm) throughout the depth of the boring, 0 to 14 feet bls.

3.3.3 LABORATORY-ANALYSES RESULTS

Laboratory analyses for VOCs, PAH compounds, and TPH were performed on soil samples collected from Soil Boring 02-SB-01, groundwater samples from Monitor Well 02-MW-01, surface water samples, and sediment samples collected from the base of the drainage ditch. The locations of these sampling points are shown in Figure 3-4. The results of the laboratory analyses are shown in Table 3-3A and 3-3B and summarized on Figure 3-4.

The laboratory analyses of the soil samples detected numerous PAH compounds in concentrations ranging from 86 to 190 µg/kg in the upper soil sample, collected from 0 to 2 feet bls. The presence of these compounds may be due to overland flow from the washrack area percolating into the upper soils. No VOC contaminants were detected. TPH was measured at 357 mg/kg. In the lower soil sample, collected from 6 to 8 feet bls, no organic compounds were detected above detection limits.

In the groundwater sample collected from Monitor Well 02-MW-01, no organic compounds were detected at levels above the detection limits with the exception of TPH, which was found at 0.08 mg/l. These results may indicate that the groundwater at Site No. 2 has been unaffected by the activities at the washrack.

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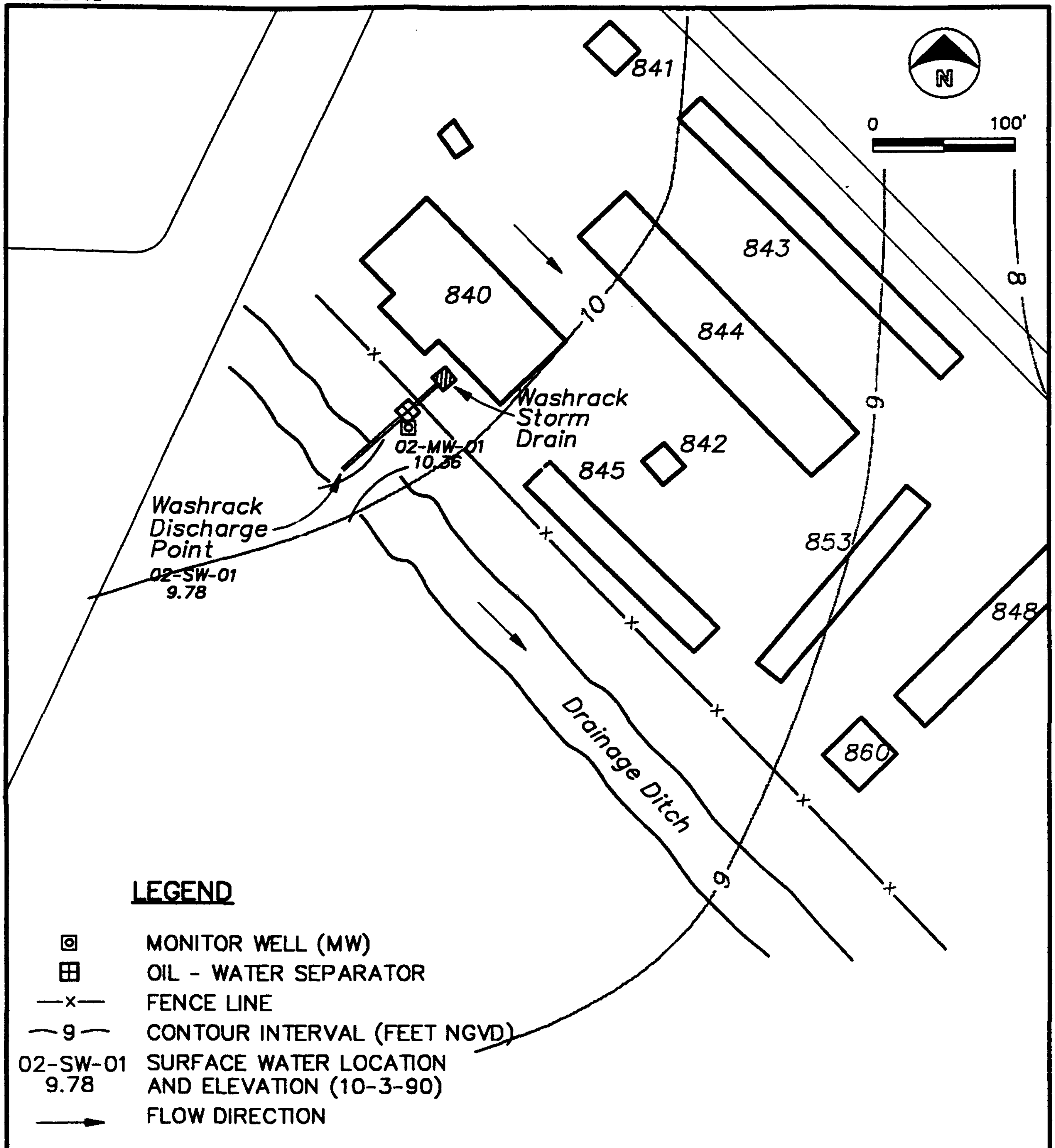


FIGURE 3-3

SITE NO. 2
CRTC VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

F:\P_SMITH\04SITE2.DWG

TABLE 3-3A

SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT

SITE NO. 2 - CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

GEORGIA AIR NATIONAL GUARD BASE

SAVANNAH, GEORGIA

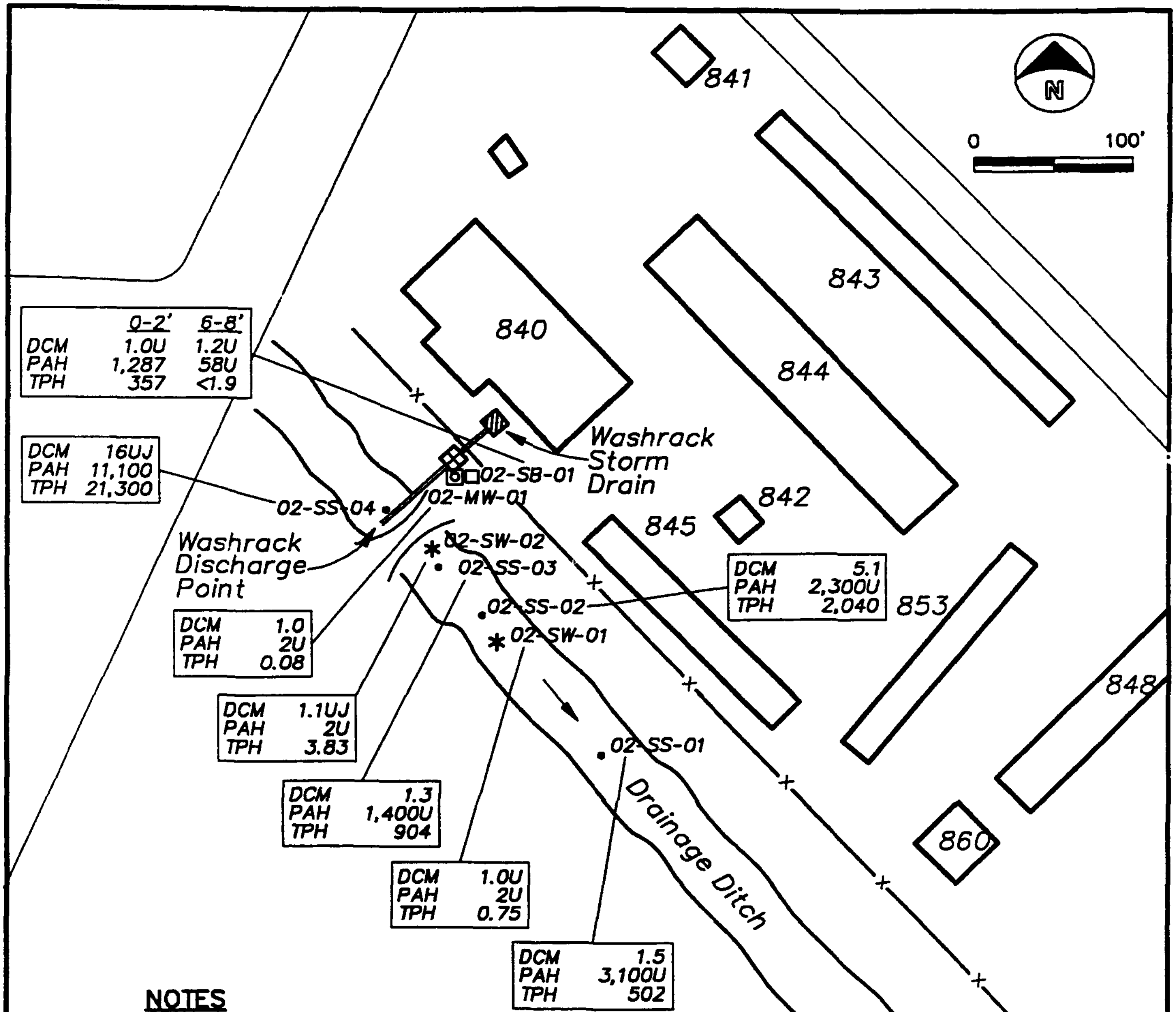
Sample	DCM	Phenan-threne	Anthracene	Fluoran-thene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) Pyrene	Ideno(1,2,3 -cd)pyrene	Benzo(g,h,i) perylene	TPH
I. Soil Boring Samples													
02-SB-01 (0-2'bls)	1.0 U	160	35 J	190	180	100	140	100	91	86	53 U	53 U	357
02-SB-01 (6-8'bls)	1.2 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	<1.9
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	1.1 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	13.1
II. Sediment Samples													
02-SS-01	1.5 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	3100 U	502
02-SS-02	5.1 U	2300 U	2300 U	1000 J	830 J	2300 U	2300 U	2300 U	2300 U	2300 U	2300 U	2300 U	2040
02-SS-03	1.3 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	1400 U	904
02-SS-04	16 U	2900	1700 U	3300	2800	1400 J	2100	1300 J	740 J	1400 J	1100 J	920 J	21300
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria was not met or amount detected is below detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per kilogram (ug/kg)except for TPH
Concentrations for TPH expressed as milligrams per liter (mg/l) for water samples and milligrams per kilogram (mg/kg) for soil samples.
* = Background soil values taken from soil boring 09-SB-01 (0-2'bls)

TABLE 3-3B
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 2 – CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	DCM		TPH
I.	Groundwater Samples			
	02-MW-01	1.0	U	0.08
	Action Levels	NA		NA
	Background*	1.0	U	<0.06
II.	Surface Water Samples			
	02-SW-01	1.0	U	0.75
	02-SW-02	1.1	UJ	3.83
	Action Levels	1578		NA
	Background*	NA		NA

Notes:
MW = Monitor Well
SW = Surface Water
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria was not met or amount detected is below detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per liter (ug/l) except for TPH
Concentrations for TPH expressed as milligrams per liter (mg/l)
* = Background groundwater values taken from monitor well 09-MW-05



NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kl FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS ug/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM DICHLOROMETHANE

PAH POLYNUCLEAR AROMATIC HYDROCARBONS, VALUE WITHOUT QUALIFIER EQUALS SUM TOTAL OF DETECTED PAH'S

TPH TOTAL PETROLEUM HYDROCARBONS

LEGEND

□ SOIL BORING (SB)

◙ MONITOR WELL (MW)

• SEDIMENT SAMPLE (SS)

* SURFACE WATER SAMPLE (SW)

⊞ OIL-WATER SEPARATOR

—x— FENCE LINE

—► FLOW DIRECTION

FIGURE 3-4

SITE NO. 2
CRTC VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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Organic compounds in the surface water samples were below method detection limits with the exception of TPH, which was detected at slightly elevated concentrations.

The analyses of the sediment samples, which were collected along the length of the drainage ditch, detected elevated PAH compounds and TPH in each of the samples. The detected concentrations appeared to decrease with distance from the point of discharge.

3.3.4 SUMMARY

The results of the field screening and laboratory analyses indicate that two areas have elevated levels of contamination. The upper 3 feet of the soil surrounding the washrack appears to contain elevated levels of organic contaminants. This contamination may be due to percolation of washwater and stormwater runoff from the washrack area. The ditch that borders Site No. 2 appears to contain low levels of organic contamination in the sediments. Low levels of TPH (0.75 to 3.83 mg/kg) were detected in both surface water samples. Elevated levels of PAH compounds and TPH were observed in the four sediment samples. The sample collected at the point of discharge showed the highest levels of TPH (21,300 mg/kg) and contained several PAH compounds in concentrations of about 3,000 μg/kg. The TPH contamination at this site appears greatest at the point of discharge and decreases with distance.

3.4 SITE NO. 5--165TH BULK FUEL FACILITY

3.4.1 TOPOGRAPHY AND HYDROGEOLOGY

Site No. 5 is in the topographically lowest area of the nine sites investigated at GANGB. Ground surface elevations ranged from approximately 11 to 15 feet NGVD and demonstrated a gradual downward inclination to the southeast. The area surrounding the site is predominantly undeveloped. From the northeast to northwest, there is a large parcel of undeveloped, wooded land not owned by GANGB or the Savannah Airport Commission. To the west and south, there are substantial grassy areas between adjacent structures. The Bulk Fuel Facility is primarily paved with asphalt or concrete.

Stormwater from the Bulk Fuel Facility flows radially toward unpaved areas and is collected in a series of ditches surrounding the perimeter of the site. Most of the stormwater collected in the ditches percolates into the groundwater from the ditches on the northeast and northwest sides of the facility. During the SI, surface water was pooled in these ditches and the low-lying areas. During periods of excess rainfall, stormwater is channeled away from the Bulk Fuel Facility by a ditch that parallels Mikell Avenue and intersects the larger drainage ditch that runs southeast behind Site No. 2. A second stormwater pathway is along the abandoned railroad tracks.

This drainage pattern receives stormwater from the north side of the property and travels east into the wooded area where it accumulates in a topographic depression.

Soil profiles were prepared for Site No. 5 during the installation of eight shallow hand-auger borings, five soil borings, and four well borings. In general, the soil profiles show a layer of surficial sands from the ground surface to approximately 2 to 4 feet bls. The surface sands were moderately dense and may contain traces of silt and surface organics. Below the surficial sands was a layer of clayey sand to approximately 6 to 8 feet bls. This layer varied in composition from a clayey sand to a semi-stiff plastic clay. The apparent permeability of this layer is lower than the permeability of the surficial sands. The clayey sands ranged in color from grayish tan to reddish brown.

In several locations along the northeast side of the Bulk Fuel Facility, a second layer of clean, highly permeable sand was encountered below the clay layer. The sand was fine, moderately well-graded, and gray. In most locations the groundwater surface was encountered at approximately 8 feet bls. As the ground surface dipped to the east-southeast, groundwater was encountered nearer to the ground surface at 3 to 4 feet bls.

On July 13, 1990, groundwater elevations were measured from two newly installed piezometers and two existing wells at Site No. 5 and from a surface-water control point at Site No. 2. A generally flat potentiometric surface interrupted by drainage ditches on the northwest side of the site and by the pavement overlying the Bulk Fuel Facility was observed. From a regional view, it appears that groundwater generally flows east across Site No. 5. The drainage ditches on the northwest side of the site have developed slight depressions, and the paved areas overlying the facility appear to have produced a slight groundwater mound.

Following the installation of monitor wells at the site, a second set of ground water measurements was collected. On October 3, 1990, measurements were collected from the points used in the July 13 data set and from one new well installed at Site No. 2 and four new wells installed at Site No. 5. Figure 3-5 shows the contours developed using these measurements. From these contours, it appears that groundwater flows across Site No. 5 to the north-northeast. There is a groundwater divide in the grassy area to the south of the Bulk Fuel Facility. From this divide, groundwater may flow either north across the facility or south, eventually intersecting a distant drainage ditch. Using these data, a groundwater gradient of approximately 0.0041 was estimated.

On October 1, 1990, a slug test was performed at Monitor Well 05-MW-02. The slug test was performed as a "slug-out" or recovery test to examine the surrounding formation. The aquifer test yielded a hydraulic conductivity value of about 14.54 fpd (5.13×10^{-3} cm/s). This value is consistent with soil classifications and with other values obtained around GANGB.

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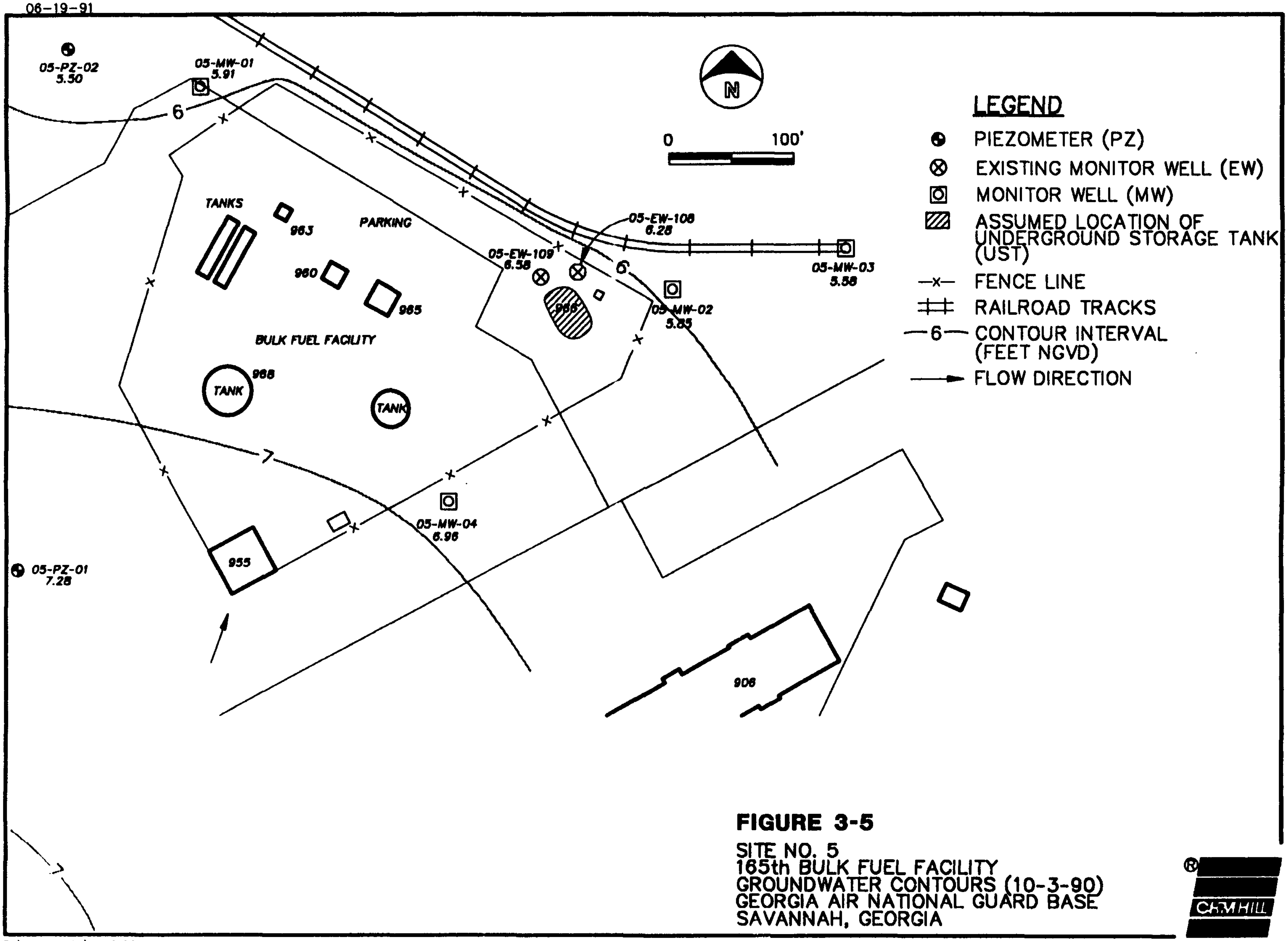

FIGURE 3-5

SITE NO. 5
165th BULK FUEL FACILITY
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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Using the observed gradient of 0.0041, the estimated hydraulic conductivity of 14.54 fpd (5.13×10^{-3} cm/s), and an assumed value of porosity of 0.40, it was estimated that groundwater flows across Site No. 5 to the north-northeast at approximately 0.15 fpd.

3.4.2 FIELD-SCREENING RESULTS

Field activities consisted of performing an SOV survey at 30 sampling points, collecting soil samples for head-space analyses from 13 hand-auger borings, and performing head-space analysis on soil samples collected from 5 soil borings. The locations of these sampling points are shown in Figure 2-3. In the SOV survey, toluene and total xylenes were detected at low concentrations in most samples. Although some of the samples may have contained these target compounds, vapors emanating from the Bulk Fuel Facility may have influenced the samples. No air quality sampling was performed to confirm this; however, fuel odors were evident, and these could impact field screening results.

In addition to the SOV survey, 13 hand-auger borings (and one duplicate sample) were performed to collect soil samples for head-space analyses. These borings were used in areas that were wet or inaccessible to a drilling rig. Samples 05-HA-01 through 05-HA-08 were screened in the field using an hNu. In each sample, except samples 05-HA-02 and 05-HA-08, very high levels of volatile contamination were detected. Field hNu readings varied between 60 and 220 ppm. Because of the high contaminant concentrations, these samples were not analyzed using the field gas chromatograph. Soil samples collected from Hand-auger Borings 05-HA-09 through 05-HA-14 were analyzed using head-space techniques. Each of the samples yielded elevated levels of volatile target compounds.

Five soil borings were performed at or near the areas of the SOV and head-analyses detections. Two samples were collected from each of the soil borings, one at a depth of approximately 2 feet bls and the other at the soil-groundwater interface. Each soil sample was analyzed using the field gas chromatograph and head-space techniques. In general, low levels of organics were detected in each of the samples. However, in samples collected from Soil Boring 05-SB-04, each of the 5 target compounds was detected.

The use of the field gas chromatograph met with varying amounts of success at Site No. 5. In the perimeter SOV survey (performed at 50-foot intervals around the enclosure of the POL), approximately 5 discrete "hot-spots" were identified during field screening. As a result of the screening detections, soil borings were performed at five locations to confirm the presence of contamination. Of the five soil borings performed, only one confirmed the presence of target compounds. The reason for this discrepancy was most likely ambient air quality or sample collection methods. As stated previously, fuel odors were evident in the vicinity of the POL. This may have impacted field screening results.

3.4.3 LABORATORY-ANALYSES RESULTS

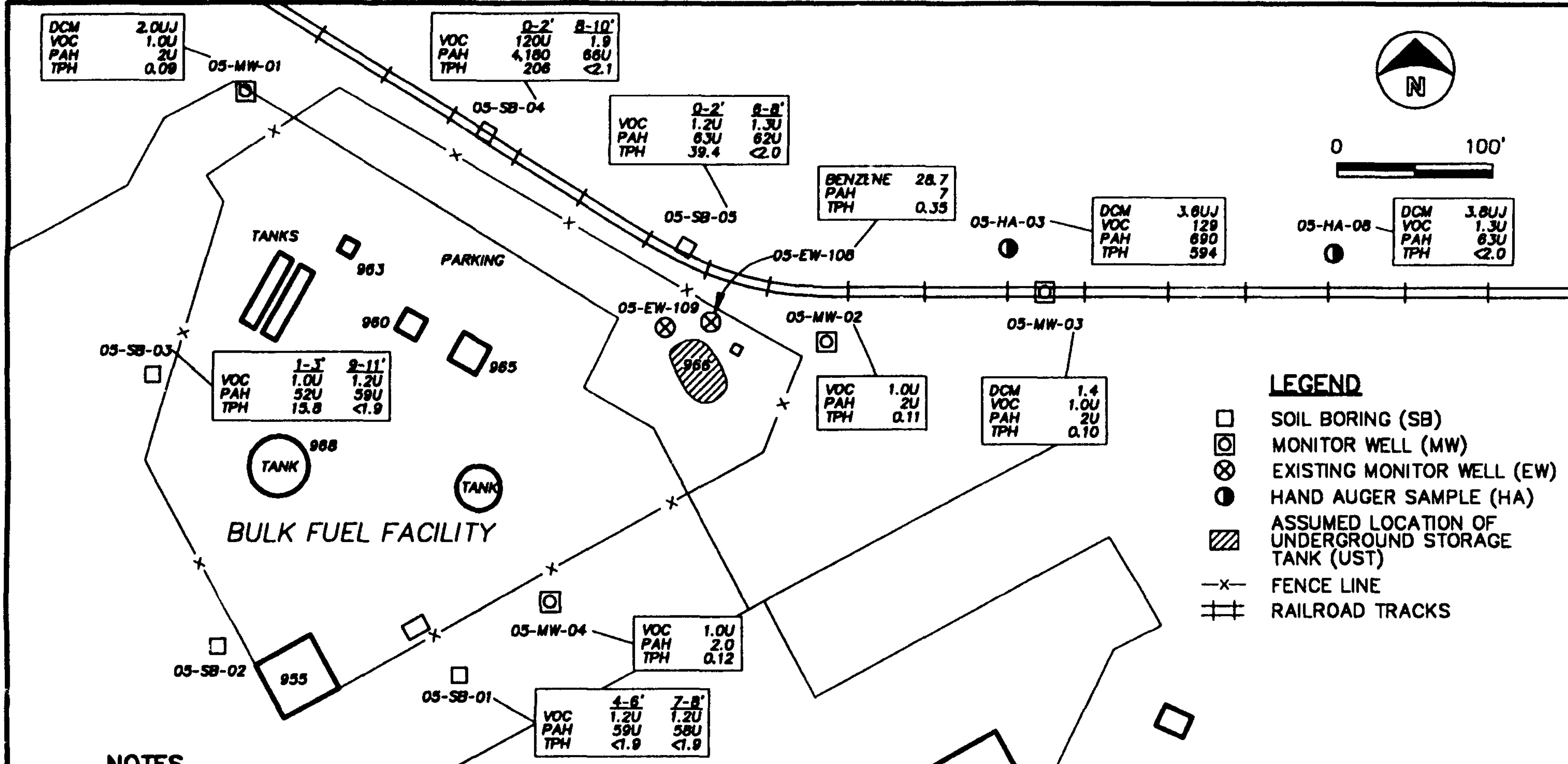
Laboratory analyses were performed on samples from two hand-auger borings, four soil borings, four new groundwater monitor wells, and one existing monitor well. The locations of these sampling points are shown in Figure 3-6. Samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. The results of the laboratory analyses are shown in Tables 3-4A, 3-4B, 3-5A and 3-5B and also summarized on Figure 3-6.

Soil samples were collected from two of the hand-auger borings. Sample 05-HA-03 was collected from a ditch near the location where a spill was reported to have occurred. In this sample, dichloromethane, toluene, ethylbenzene, and total xylenes were detected at concentrations of 3.6, 29, 28, and 72 μg/kg, respectively. In addition, several PAH compounds were detected at concentrations of several hundred μg/kg. Sample 05-HA-08 was collected downgradient from the location where an overland fuel spill had accumulated. VOCs and PAH compounds were not detected with the exception of dichloromethane, which is most likely a laboratory artifact. Arsenic, chromium, copper, lead, and zinc were detected in at least one of the two samples from the hand-auger borings.

Soil samples were also analyzed from two depths at each of four soil borings. Organic contamination was only detected in samples from Soil Boring 05-SB-04 collected north of the Bulk Fuel Facility next to the property boundary. In the sample collected at 0 to 2 feet bls, naphthalene, 2-methylnaphthalene, and 1-methylnaphthalene were detected in concentrations of 980, 2,000, and 1,200 μg/l, respectively. In the soil sample collected from 8 to 10 feet bls, the only organic detected was toluene at a concentration of 1.9 μg/kg. The absence of volatile contamination in the upper soil sample may be due to natural volatilization or biological degradation of the compounds. Arsenic, chromium, copper, lead, nickel, and zinc were detected in the soil samples.

Groundwater samples were collected from each of the four new monitor wells and from one existing well (05-EW-108) at the northeast corner of the Bulk Fuel Facility. Figure 3-6 shows the locations of the monitor wells. In the sample from the existing well, benzene was detected at 25 μg/l and ethyl benzene was detected at 3.7 μg/l. Dichloromethane was detected in Monitor Wells 05-EW-108 and 05-MW-03 in concentrations of 2.0 and 1.4 μg/l, respectively; however, this detection is believed to be a laboratory artifact. Naphthalene, 2-methyl naphthalene, and 1-methyl naphthalene were detected in Monitor Well 05-EW-108 located next to the existing underground storage tank. TPH was detected in all five groundwater samples. Arsenic, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc were also detected in the groundwater samples. Lead was measured at 47 and 23 μg/l in the unfiltered samples from Monitor Wells 05-MW-01 and 05-MW-03, respectively, but lead concentrations were less than 2 μg/l in the filtered samples.

06-19-91



NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM DICHLOROMETHANE

VOC VOLATILE ORGANIC COMPOUNDS, VALUE WITHOUT QUALIFIER EQUALS SUM TOTAL OF DETECTED VOC'S

PAH POLYNUCLEAR AROMATIC HYDROCARBONS, VALUE WITHOUT QUALIFIER EQUALS SUM TOTAL OF DETECTED PAH'S

TPH TOTAL PETROLEUM HYDROCARBONS

FIGURE 3-6

SITE NO. 5
165th BULK FUEL FACILITY
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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TABLE 3-4A
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT
SITE NO. 5 - BULK FUEL FACILITY
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM	Toluene	Benzene	Ethyl benzene	Total Xylenes	Naphthalene	2-Methyl Naphthalene	1-Methyl Naphthalene	TPH
I. Hand Augered Soil Samples									
05-HA-03	3.6 UJ	29	1.2 U	28	72	220	250	220	594
05-HA-08	3.8 UJ	1.3 U	1.3 U	1.3 U	1.3 U	63 U	63 U	63 U	<2.0
II. Soil Boring Samples									
05-SB-01 (4-6'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	59 U	59 U	59 U	<1.9
05-SB-01 (7-8'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	58 U	58 U	58 U	<1.9
05-SB-03 (1-3'bls)	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	52 U	52 U	52 U	15.8
05-SB-03 (9-11'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	59 U	59 U	59 U	<1.9
05-SB-04 (0-2'bls)	120 U	120 U	120 U	120 U	120 U	980	2000	1200	206
05-SB-04 (8-10'bls)	1.3 U	1.9	1.3 U	1.3 U	1.3 U	66 U	66 U	66 U	<2.1
05-SB-05 (0-2'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	63 U	63 U	63 U	39.4
05-SB-05 (6-8'bls)	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	62 U	62 U	62 U	<2.0
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	56 U	56 U	56 U	13.1

Notes:
HA = Hand Auger
SB = Soil Boring
bls = Below Land Surface
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria was not met or amount was below detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per kilogram (ug/kg) Except for TPH
Concentrations for TPH expressed as milligrams per kilogram (mg/kg)
* = Background soil values taken from soil boring 09-SB-01 (0-2'bls)

TABLE 3-4B

SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR GROUNDWATER

SITE NO. 5 - BULK FUEL FACILITY

GEORGIA AIR NATIONAL GUARD BASE

SAVANNAH, GEORGIA

Sample	DCM	Toluene	Benzene	Ethyl benzene	Total Xylenes	Naphthalene	2-Methyl Naphthalene	1-Methyl Naphthalene	TPH
I. Groundwater Samples									
05-EW-108	1.0 U	1.0 U	25	3.7	1.0 U	2	3	2	0.35
05-MW-01	2.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.09
05-MW-02	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.11
05-MW-03	1.4 UJ	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.10
05-MW-04	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.12
Action Levels	NA	NA	5	NA	NA	NA	NA	NA	NA
Background*	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.06

Notes:
EW = Existing Well
MW = Monitor Well
DCM = Dicholormethane
TPH = Total Petroleum Hydrocarbon
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria was not met or amount was below detection limit
NA = Not available or applicable
Concentrations expressed as micrograms per liter (ug/l) except for TPH
Concentrations for TPH expressed as milligrams per liter (mg/l)
* = Background groundwater levels taken from monitor well 09-MW-05

TABLE 3-5A
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES IN SOIL
SITE NO. 5 - BULK FUEL FACILITY
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
I. Hand Augered Soil Samples											
05-HA-03	6.0	0.074	<0.19	8.1	3.3	5.4	0.088	1.3	0.13	<0.79	5.9
05-HA-08	11.2	0.17	<0.20	4.1	2.1	4.5	0.098	1.8	0.22	0.84	8.6
II. Soil Boring Samples											
05-SB-01 (4-6'bls)	1.1	<0.59	<0.59	16.5	<1.2	9.4	<0.02	3.5	<1.5 J	<1.2	7.1
05-SB-01 (7-8'bls)	1.8	<0.59	<0.59	12.3	<1.2	4.7	<0.02	<2.9	<1.5 J	<1.2	4.7
05-SB-03 (1-3'bls)	2.1	<0.52	<0.52	4.7	<1.0	9.3	<0.02	<2.6	<1.3 J	<1.0	5.2
05-SB-03 (9-11'bls)	0.45	<0.60	<0.60	7.2	<1.2	3.0	<0.02	<3.0	<1.5 J	<1.2	1.8
05-SB-04 (0-2'bls)	6.8	<0.62	<0.62	26.2	1.2	13.1	<0.02	<3.1	<1.5 J	<1.2	16.2
05-SB-04 (8-10'bls)	0.37	<0.65	<0.65	7.8	1.3	7.1	<0.03	<3.2	<1.6 J	<1.3	3.2
05-SB-05 (0-2'bls)	9.4	<0.60	<0.60	23.4	2.4	7.2	<0.02	7.2	<1.5 J	<1.2	0.42
05-SB-05 (6-8'bls)	0.83	<0.63	<0.63	13.2	8.1	3.8	<0.03	4.4	<1.6 J	<1.2	15.0
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	4	<0.56	<0.56	15.6	<1.1	3.9	<0.02	<2.8	<1.4	<1.1	3.9

Notes:
HA = Hand Auger
SB = Soil Boring
NA = Not available or applicable
bls = Below Land Surface
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls).
J = Concentration estimated because quality control criteria was not met or amount was below detection limit
Antimony and Thallium were tested for, but neither was detected.
Concentrations expressed as milligrams per kilogram (mg/kg).

TABLE 3-5B
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR GROUNDWATER
SITE NO. 5 - BULK FUEL FACILITY
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Groundwater Samples											
05-EW-108	0.015	<0.005	<0.0002	0.002	<0.02	NS	<0.002	<0.0002	<0.04	<0.01	0.03
05-MW-01	0.043 J	0.02	0.0009	0.099 J	0.02	<0.002 J	0.047 J	<0.0002	<0.04	0.02	0.13
05-MW-02	0.011 J	<0.005	0.0008	0.033 J	<0.02	NS	0.022 J	<0.0002	<0.04	0.01	0.011
05-MW-03	<0.005 J	<0.005	<0.0002	0.046 J	<0.02	<0.002 J	0.023 J	<0.0002	<0.04	<0.01	0.05
05-MW-04	<0.005 J	<0.005	<0.0002	0.091 J	0.03	NS	0.043 J	<0.0002	0.04	0.02	0.12
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.05	NA
Background *	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.22	0.0003	<0.04	0.011	0.08

Notes:
MW = Monitor Well
EW = Existing Well
F = Filtered sample
UF = Unfiltered sample
J = Concentration estimated because quality control criteria was not met or amount was below detection limit
NS = Not Sampled
* = Background groundwater values taken from monitor well 09-MW-05
Antimony and Thallium were tested for, but neither was detected
Concentrations expressed as milligrams per liter (mg/l)

3.4.4 SUMMARY

Site No. 5 posed several challenges during the SI. These included the difficulty in interpreting the groundwater flow patterns and in determining the offsite migration pathways. Soil contamination was detected at Site No. 5 along the northeast property boundary. The contamination, limited to 3 to 5 feet bls along the drainage ditch, appears to be the result of a surface spill. A unit of lower permeable material appears to have acted as a confining unit restricting vertical migration of the contaminants.

Several sets of data were obtained during the SI which support the theory that a unit of confinement exists at Site No. 5. In particular, eight hand augured borings were installed in the vicinity of the drainage ditch, two soil borings and three well borings were performed on the northeast property boundary, and four monitor wells were sampled in this area. In each of the boring locations, a sandy-clay layer was encountered at 2 to 4 feet bls. The layer was observed to be approximately 4 to 6 feet thick and underlain by a poorly graded fine sand. Descriptions for this material ranged from a clayey-sand to a moderately plastic clay. Visual classification of the material suggests that the permeability of the sandy clay layer was between one and two orders of magnitude less than the overlying fine sand layer.

In several of the soil, well, and hand augured borings, fuel odors were apparent within the sandy-clay material. Fuel odor and organic vapors, however, were not encountered in the fine sand below the sandy-clay layer. Three wells were installed in the vicinity of the observed soil contamination. The wells were installed with the screened interval extending from the base of the sandy-clay layer into the fine sand unit below. In each location, VOCs were not detected. However, VOCs were detected in the existing well (05-EW-108 located near the underground storage tank [UST]).

Based on the field observations and confirmatory samples, it appears that the sandy-clay layer offers some confinement. Although the extent of the confinement is unknown, groundwater contamination along the northeast property boundary is less than would be anticipated given the degree of surface soil contamination. Further investigation will be needed to confirm the extent of groundwater contamination.

3.5 SITE NO. 6--165TH VEHICLE MAINTENANCE SPILL AREA

3.5.1 TOPOGRAPHY AND HYDROGEOLOGY

Site No. 6 is east of the 165th Vehicle Maintenance Area. The site is moderately flat with a slight topographic decline to the southeast. Ground surface elevations ranged from approximately 31 feet NGVD along Headquarters Road, the site's west boundary, to 23 feet NGVD in the lowest-lying areas, east of the site.

Stormwater runoff at this site follows the topographic gradient to the southeast. During the SI, it was observed that a low-lying area, approximately 40 feet from the southeast corner of the facility, frequently contains standing water. During periods of excessive rainfall, surface water is ultimately diverted to a drainage ditch approximately 200 yards north of the site.

Surface soils at this site varied greatly. The 165th Vehicle Maintenance Facility is on filled pad of approximately 3 feet. Native soils at this site appeared rather clean and free-draining, and a distinct absence of clay was observed during drilling activities. Surface organics were prevalent to 1 foot bls in the wooded area behind the site. The organic material ranged from mulch to organic soils. Substantial roots were encountered to 4 feet bls. Surface soils were typically poorly graded with very few fines. The soils ranged in color from brown to yellowish red. Below this depth, a greenish gray sand layer was encountered. This layer was moderately permeable and was typically located at the surface of the groundwater table.

Depth to water measurements ranged from 2 to 4 feet bls. On July 13, 1990, groundwater measurements were collected from two piezometers installed at Site No. 6. These measurements were used with measurements collected on the same day from Site No. 1 and Site No. 7 to estimate groundwater flow direction.

A second series of groundwater measurements was collected on October 3, 1990. This data set included a newly installed monitor well at Site No. 6 and the two previously installed piezometers. These data were combined with surface and groundwater measurements collected on the same day from Site No. 1 and Site No. 7 to prepare a more refined depiction of the groundwater surface. Figure 3-7 shows the contours projected using the data from October 3, 1990. From these contours, a gradient of 0.015 to the southeast was estimated.

Both sets of contours show a groundwater flow pattern to the southeast. This pattern follows the ground surface and confirms the regionally presumed groundwater flow pattern. When the groundwater flow from Site No. 6 is projected onto a larger area, which includes Sites No. 1 and No. 7, it appears that groundwater flows across Site 6 to the southeast and then is directed to the northeast where it is intercepted in a drainage ditch.

A slug test was performed in Monitor Well 06-MW-01. This well was installed using a hand auger and penetrated the groundwater surface by approximately 18 inches. The slug test yielded a hydraulic conductivity value of approximately 331.65 fpd (1.17×10^{-1} cm/s). Although the soil appeared moderately permeable, this value appears above the acceptable range for a poorly graded sand.

Monitor Well 06-MW-01 was installed using a hand auger, which produced a large borehole surrounding the well. Therefore, the high hydraulic conductivity value produced from the slug test may be more indicative of the gravel pack surrounding

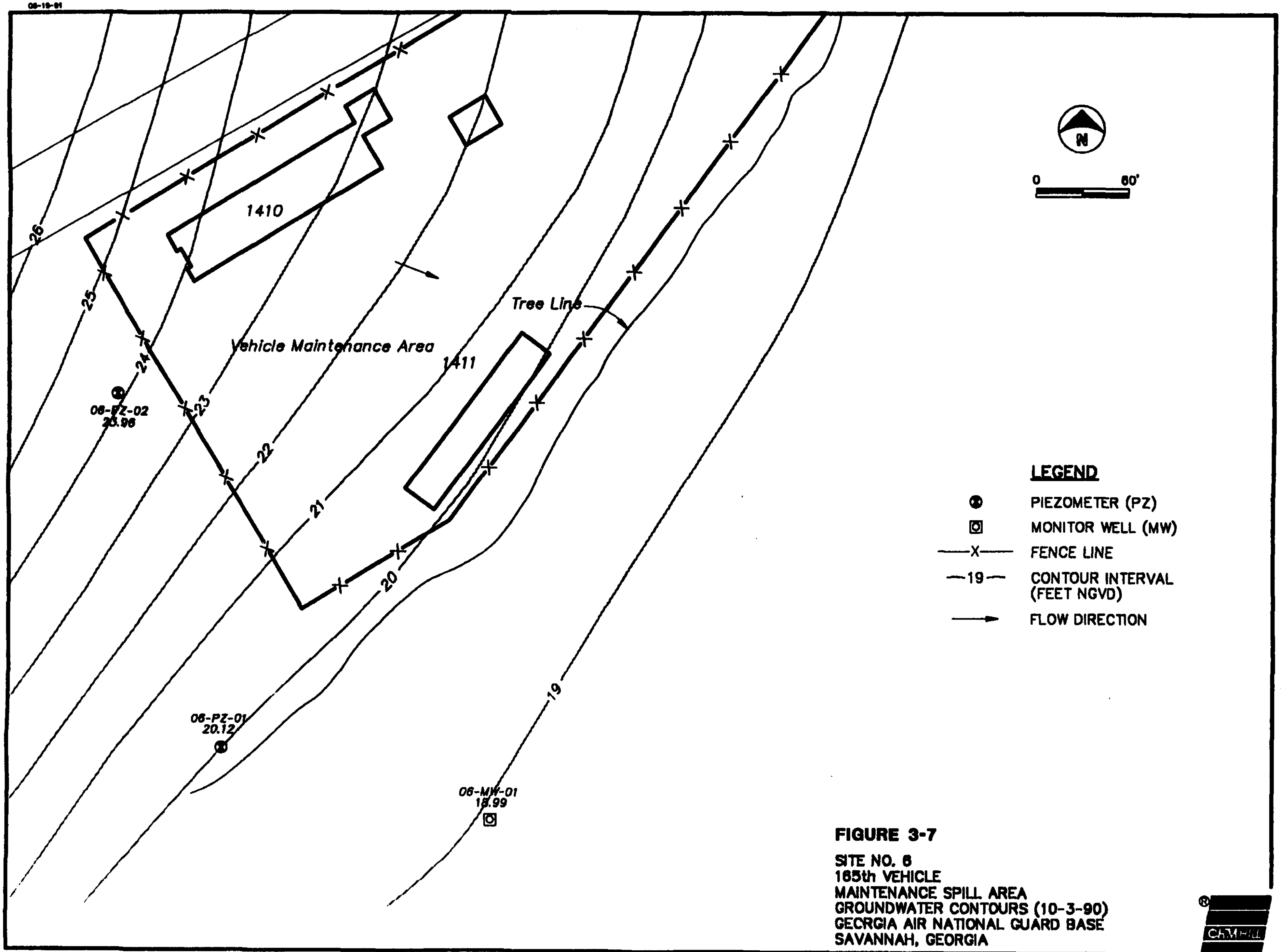


FIGURE 3-7

SITE NO. 6
165th VEHICLE
MAINTENANCE SPILL AREA
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

the well screen than of the natural soils. A more realistic value for the hydraulic conductivity would be about 14.17 fpd (5 x 10^{-3} cm/s).

Using the observed gradient of 0.015, an assumed hydraulic conductivity of 14.17 fpd, and an assumed porosity of 0.40, a groundwater flow velocity of 0.53 fpd to the southeast was estimated.

3.5.2 FIELD-SCREENING RESULTS

Field screening at the 165th Vehicle Maintenance Spill area consisted of conducting a series of hand-auger borings to the water table, which was approximately 3.5 feet bls. Additional borings were also performed in low-lying areas. The locations of the samples are shown in Figure 2-4. Soil samples produced from the borings were analyzed using the field gas chromatograph and head-space techniques.

The head-space analysis of each of the soil samples indicated the presence of most of the target compounds, even though a preliminary screening of the samples in the field, (using an hNu), did not detect volatile compounds in similar concentrations. It is unknown at this time what caused this inconsistency. In the field, hand-auger samples were inspected for visual signs of contamination and/or odor, and the samples appeared free of noticeable contamination. In this location, it appears that fugitive vapors from aircraft exhaust may have influenced screening results. Screening, using the field gas chromatograph, yielded very limited usefulness at this site.

3.5.3 LABORATORY-ANALYSES RESULTS

Four soil samples from hand-auger borings and one groundwater sample were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. Table 3-6 and Table 3-7 shows the results of the analyses.

The analyses indicated the presence of dichloromethane in each of the hand-auger samples. This compound is a common laboratory artifact due to its use in extracting samples and is probably not indicative of the presence of the compound at the site. Toluene was detected in the sample from Soil Boring 06-HA-09 at a concentration of 1.3 μg/kg.

Monitor Well 06-MW-01 was installed downgradient of the spill area approximately 175 feet south of the fence line. In the groundwater sample from this well, VOCs or PAH compounds were not detected above the detection limits; however, TPH was detected at 0.09 μg/l, which may reflect the compounds produced when the fuel components degraded. Figure 3-8 shows the locations of these samples and summarized the results.

TABLE 3-6

SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL AND GROUNDWATER
SITE NO. 6 - 165th VEHICLE MAINTENANCE SPILL AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	DCM	Toluene	TPH
I.	Hand Augered Soil Samples			
	06-HA-02	2.5 UJ	1.2 U	<2.0
	06-HA-08	2.4 UJ	1.2 U	<2.2
	06-HA-09	2.7 UJ	1.3	<2.0
	06-HA-17	2.5 UJ	1.2 U	<2.0
	Action Levels	NA	NA	NA
	Background *	1.1 U	1.1 U	13.1
II.	Groundwater Samples			
	06-MW-01	1.0 U	1.0 U	0.09
	Action Levels	NA	NA	NA
	Background *	1.0 U	1.0 U	<0.06

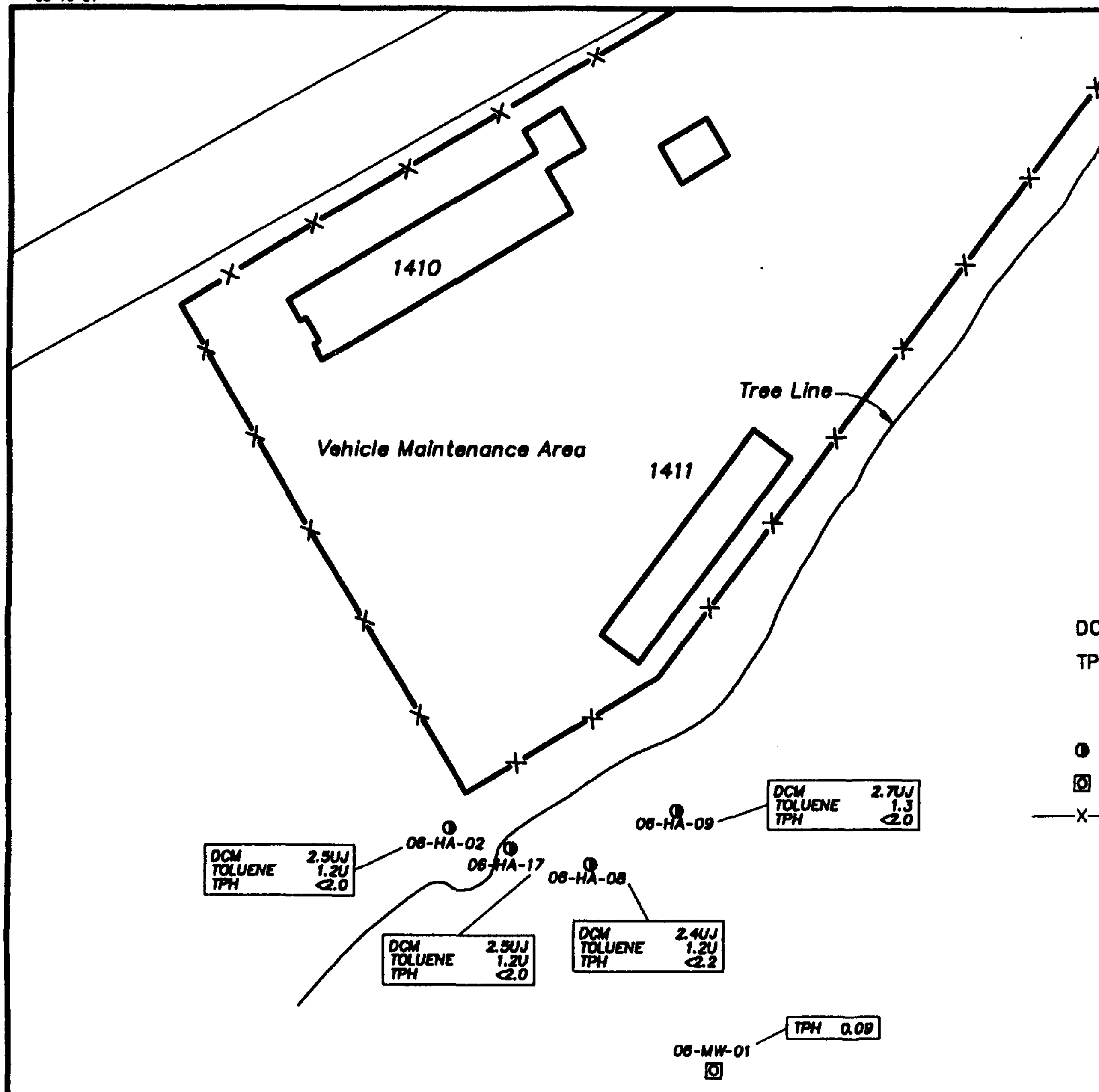
Notes:
HA = Hand Auger
MW = Mointor Well
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
NA = Not available or applicable
U - Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria was not met or amount detected was below the detection limit
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls) and background groundwater values taken from monitor well 09-SB-05
Concentrations expressed as micrograms per liter (ug/l) for water samples or micrograms per kilograms (ug/kg) for soil samples
Concentration for TPH expressed as milligrams per liter (mg/l) for water samples and milligrams (mg/kg) for soil samples

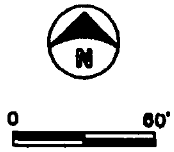
TABLE 3-7
SUMMARY OF PRIORITY POLLUTANT METAL SAMPLE ANALYSES FOR SOIL AND GROUNDWATER
SITE NO. 6 - 165th VEHICLE MAINTENANCE SPILL AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Selenium	Silver	Zinc
I. Hand Augered Soil Samples												
06-HA-02	0.088	0.0080	<0.20	1.4	2.1	NS	2.3	0.11	0.71	<0.13	<0.82	4.5
06-HA-08	0.21	<0.0053	0.23	1.6	2.2	NS	2.3	0.10	1.0	0.21	<0.89	5.5
06-HA-09	0.35	0.010	<0.21	2.0	1.3	NS	4.4	0.12	1.3	<0.14	<0.87	2.6
06-HA-17	0.22	0.0090	<0.20	1.8	1.3	NS	3.2	0.11	2.3	<0.13	0.83	7.8
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	4.0	<0.56	<0.56	15.6	<1.1	NS	3.9	<0.02	<2.8	<1.4	<1.1	3.9
II. Groundwater Samples												
06-MW-01	<0.005	<0.005	0.004	0.129	0.02	<0.002	0.064	<0.0002	<0.04	0.232 J	<0.01	0.11
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.01	0.05	NA
Background *	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.022	0.0003	<0.04	<0.025 R	0.011	0.08

Notes:
HA = Hand Auger
MW = Monitor Well
F = Filtered sample
UF = Unfiltered sample
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria was not met or amount detected was below the detection limit
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls) and background groundwater values taken from monitor well 09-MW-05
Antimony and Thallium were analyzed for, but neither was detected
Concentrations expressed as milligrams per liter (mg/l) for water samples and milligrams per kilogram (mg/kg) for soil samples.

06-19-91





NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM DICHLOROMETHANE

TPH TOTAL PETROLEUM HYDROCARBONS

LEGEND

HAND AUGER SAMPLE (HA)

MONITOR WELL (MW)

—X— FENCE LINE

FIGURE 3-8

SITE NO. 6
165th VEHICLE
MAINTENANCE SPILL AREA
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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3.5.4 SUMMARY

It appears that unrecovered fuel may have degraded into unidentifiable compounds. These compounds are not specifically targeted by standard tests (as indicated by the lack of positive detection in the VOC and PAH scan) but yield positive results in a more non-specific test such as TPH. No physical evidence of residual contamination or vegetative stress was detected. The combination of the shallow water table, the organic soils, and biological activity has probably metabolized or degraded the fuel in the years since it was released.

3.6 SITE NO. 7--165TH VEHICLE MAINTENANCE WASHRACK

3.6.1 TOPOGRAPHY AND HYDROGEOLOGY

The 165th Vehicle Maintenance Facility is in a relatively flat and low-lying area. The entire facility appears to be built on a filled area that is approximately 2 to 3 feet above the natural grade. The grassy area north of the washrack area is in a slight swale created by the filled areas of Headquarters Road, to the east, and the Maintenance Facility, to the south. Ground elevations at the facility tapered gradually to the northeast and ranged from approximately 26 feet NGVD at the washrack to 23 feet NGVD at the point of discharge into the ditch.

Stormwater at this site is collected from across the pavement of the 165th Vehicle Maintenance Facility and is channeled into a small ditch on the northeast side of the facility or runs overland directly into the drainage ditch. In this manner, grease and gasoline may come into contact with the soils surrounding the maintenance site or be discharged into the drainage ditch.

Two soil profiles were performed to classify the subsurface soils. These profiles included a soil boring (07-SB-02) and a well boring (07-WB-01) installed in the grassy area north of the washrack. The subsurface conditions at this site appeared consistent between the two borings, with a layer of poorly graded surface soils that thinned to the northeast toward the drainage ditch. The surficial sand layer ranged in thickness from 2 to 4 feet and was identified as the suspected fill section near the washrack. The surface soils varied from dark gray to grayish brown and were moderately dense.

Below the surface sands, a 4-foot sandy-clay layer was identified in both profiles. The sandy clay was below the water table and dark gray in color. Its composition was dense, and it exhibited moderate plasticity. The sandy clay appeared uniform in thickness. Below the sandy clay, a well-graded sand was encountered. This formation was saturated and appeared to have high permeability. The sand, which was medium to dark gray, was encountered to the terminal depth in both borings.

Groundwater elevations at Site No. 7 were measured during the installation of a piezometer. The groundwater surface was encountered at approximately 3 feet bls. On July 13, 1990, water levels were measured in the surface water body and in the newly installed piezometer and the existing monitor wells at Site No. 7. These groundwater measurements were combined with measurements from Site No. 1 and Site No. 6 to estimate the groundwater flow direction. A groundwater gradient of 0.010 to the east-southeast was estimated.

A second set of groundwater measurements was obtained on October 3, 1990. This set included the surface water elevation and measurements from the existing monitor wells, the newly installed monitor wells, and the piezometers at Site No. 1, Site No. 6, and Site No. 7. The measurements collected on October 3, 1990, confirmed the flow pattern, but described it with slightly greater resolution. A gradient of 0.011 to the east-southeast was estimated using these data. Groundwater contours projected using the data collected on October 3, 1990, are presented in Figure 3-9.

One slug test was performed at Site No. 7 in Monitor Well 07-MW-01. The test yielded a hydraulic conductivity value of about 8.54×10^{-3} cm/s. This value is moderately high for clean sands and probably represents the properties of the lower sand unit. This value is typical for this material based on visual observations of the soil samples.

Using the projected groundwater gradient of 0.010, the estimated hydraulic conductivity of 8.54×10^{-3} cm/s, and an assumed porosity value of 0.40, an average groundwater flow velocity of 0.67 fpd was estimated.

3.6.2 FIELD-SCREENING RESULTS

Field screening was performed with an SOV survey and during installation of the soil borings. An SOV survey consisting of 12 sampling points was performed in the grassy area north of the washrack. Figure 2-5 shows the location of the field-screening sampling points. This area was selected for to identify contamination remaining from runoff from the washrack area or to detect remnants of the reported spill.

The SOV screening indicated three points with elevated concentrations of the target compounds. Two of these points (07-SG-05 and 07-SG-13) were in the wooded area northeast of the site, and one point (07-SG-10) was adjacent to the oil-water separator. In several other samples, trace quantities of toluene or total xylenes were detected at concentrations between 4 and 16 ppb.

The target compounds detected in the samples from an area by the oil-water separator appeared to be attributable to onsite discharges, but the compounds detected in the samples from the two points northeast of the site may not be attributable to Site No. 7 because of the distance of the sampling points from Site No. 7.

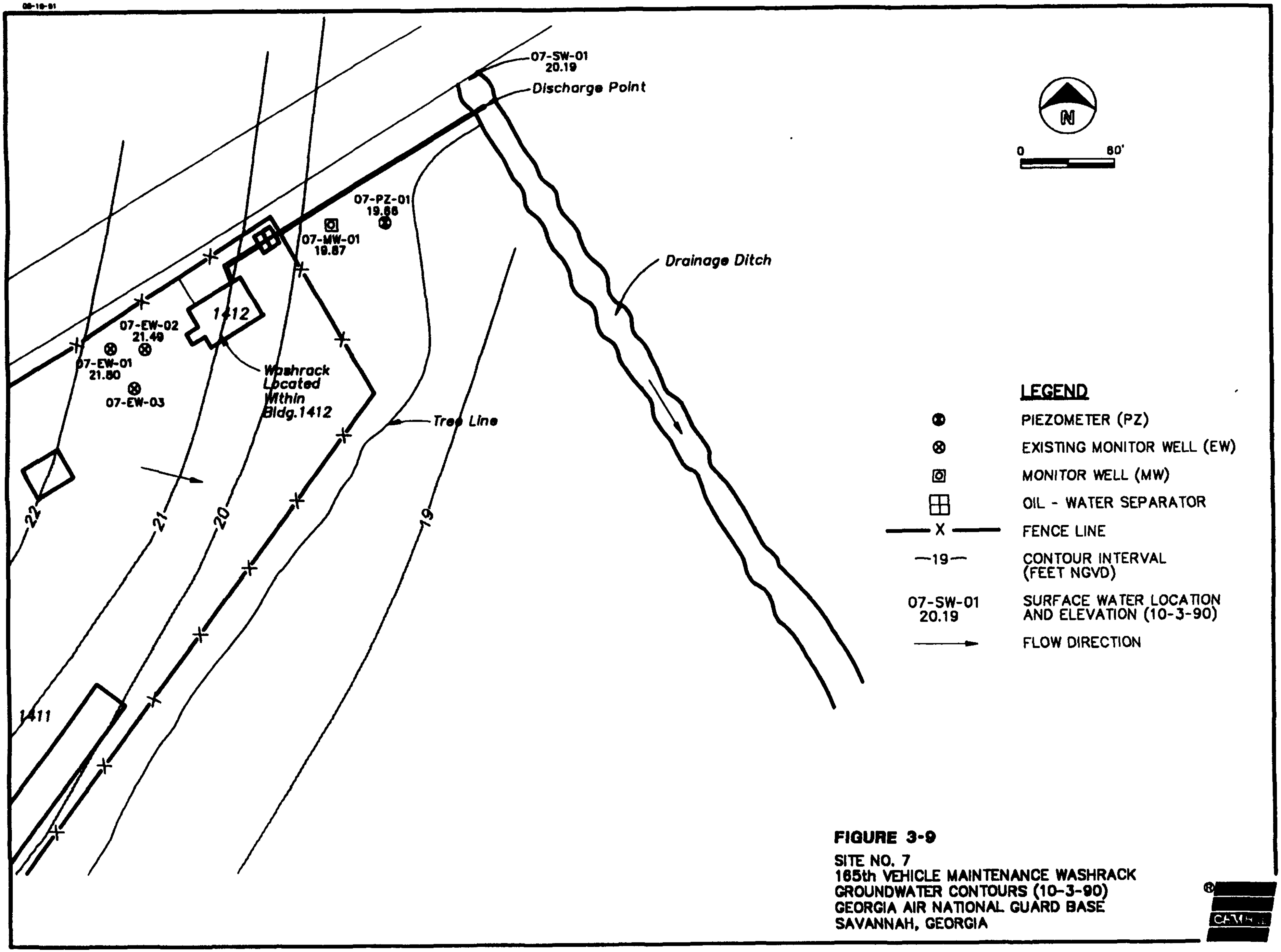


FIGURE 3-9

SITE NO. 7
165th VEHICLE MAINTENANCE WASHRACK
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

To further screen the contaminated area, a soil boring was installed near Sampling Point 07-SG-10 in the vicinity of the oil-water separator. The boring was abandoned when hNu readings in excess of 200 ppm were recorded and strong fuel odors were detected. A second boring was installed downgradient of the observed contamination. Soil Boring 07-SB-02 was screened using an hNu, and total volatile compounds were detected at about 4 ppm. Samples from Soil Boring 07-SB-02 were also collected for field screening using the gas chromatograph. The results indicated low organic concentrations.

Field screening at Site No. 7 provided useful information which assisted the site investigation. The SOV survey effectively established an area of elevated contamination around point 07-SG-10 which aided in the placement of soil borings. Additional observations made during the field scrreening were not confirmed with laboratory analysis. These observations made during field screening may have be a result of organic vapors being released from the groundwater or from aircraft exhaust being emitted approximately 100 yards west of Site No. 7.

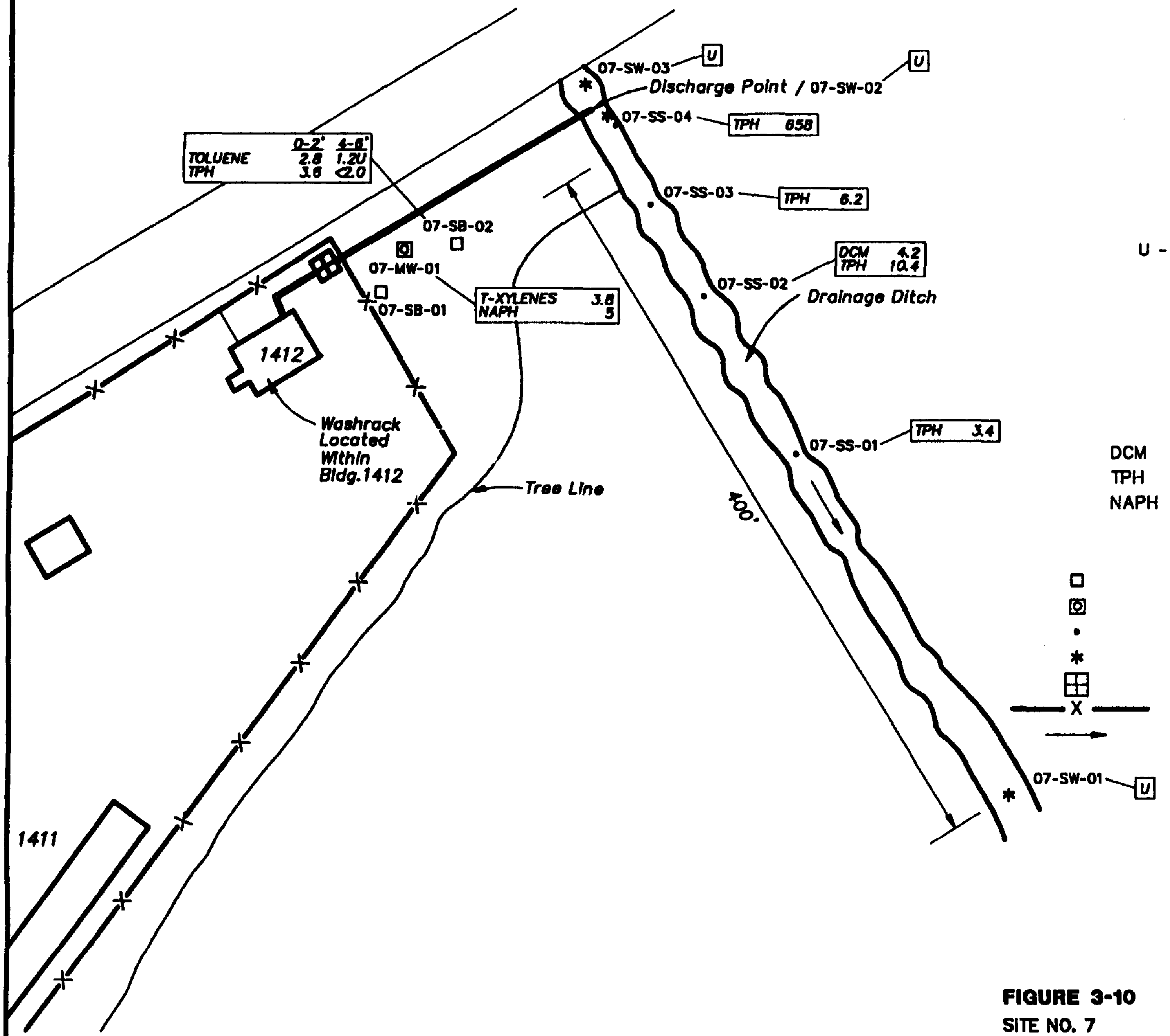
3.6.3 LABORATORY-ANALYSES RESULTS

Samples for laboratory analyses were collected from Site No. 7 from four locations. Sampling consisted of two soil samples from Soil Boring 07-SB-02, one groundwater sample from Monitor Well 07-MW-01, and three surface water samples and four sediment samples from the drainage ditch. These locations are shown in Figure 3-10. The samples were analyzed for VOCs, PAH compounds, and TPH. The results of the analyses are shown in Table 3-8A and 3-8B.

Soil samples were collected from Soil Boring 07-SB-02 at 0-2 feet bls and from 4-6 feet bls. The upper soil sample indicated a trace of toluene (2.8 µg/kg) and a slightly elevated level of TPH compounds (3.6 mg/kg). In the lower soil sample, which was collected from the clay layer, no compounds were detected above the method detection limits.

The monitor well installed at Site No. 7 was installed upgradient of Soil Boring 07-SB-02, slightly closer to the oil-water separator. The analyses of the groundwater sample indicated the presence of xylenes, naphthalene, and dichloromethane. Although dichloromethane may be a laboratory artifact, the detections indicate some low-level fuel contamination downgradient of the observed gross contamination in the soils.

The drainage ditch that receives the washrack discharge was also sampled. The analyses of three surface water samples collected at various locations along the ditch indicated values below detection limits in each sample for each analyte. The analyses of the four sediment samples, however, detected TPH in each of the samples. Concentrations of TPH ranged from 3.4 to 658 mg/kg, and in general, decreased with distance from the discharge point.



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0 60'

NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM	DICHLOROMETHANE
TPH	TOTAL PETROLEUM HYDROCARBONS
NAPH	NAPHTHALENE

LEGEND

☐	SOIL BORING (SB)
⊡	MONITOR WELL (MW)
•	SEDIMENT SAMPLE (SS)
*	SURFACE WATER SAMPLE (SW)
⊞	OIL - WATER SEPARATOR
—X—	FENCE LINE
→	FLOW DIRECTION

FIGURE 3-10

SITE NO. 7
165th VEHICLE MAINTENANCE WASHRACK
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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TABLE 3-8A

SUMMARY OF VOC PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT

SITE NO. 7 - 165TH VEHICLE MAINTENANCE WASHRACK

GEORGIA AIR NATIONAL GUARD BASE

SAVANNAH, GEORGIA

	Sample	DCM		Toluene		Total Xylenes		Naphthalene		TPH
I.	Soil Boring Samples									
	07-SB-02 (0-2'bls)	1.0	U	2.8		1.0	U	52	U	3.6
	07-SB-02 (4-6'bls)	1.2	U	1.2	U	1.2	U	58	U	<2.0
	Action Levels	NA		NA		NA		NA		NA
	Background *	1.1	U	1.1	U	1.1	U	56	U	13.1
II.	Sediment Samples									
	07-SS-01	1.1	U	1.1	U	1.1	U	59	U	3.4
	07-SS-02	4.2		1.2	U	1.2	U	60	U	10.4
	07-SS-03	1.2	U	1.2	U	1.2	U	60	U	6.2
	07-SS-04	1.3	U	1.3	U	1.3	U	130	U	658
	Action Levels	NA		NA		NA		NA		NA
	Background *	NA		NA		NA		NA		NA

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
NA = Not available or applicable
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls)
Concentrations expressed as micrograms per kilograms (ug/kg) except for TPH
Concentrations for TPH expressed as milligrams per kilogram (mg/kg)

TABLE 3-8B
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 7 - 165TH VEHICLE MAINTENANCE WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	DCM		Toluene		Xylenes		Naphthalene		TPH
I.	Groundwater Samples									
	07-MW-01	1.3	UJ	1.0	U	3.8		5		<0.06
	Action Levels	NA		NA		NA		NA		NA
	Background *	1.0	U	1.0	U	1.0	U	2	U	<0.06
II.	Surface Water Samples									
	07-SW-01	1.0	U	1.0	U	1.0	U	2	U	<0.06
	07-SW-02	1.0	U	1.0	U	1.0	U	2	U	<0.06
	07-SW-03	1.0	U	1.0	U	1.0	U	2	U	<0.06
	Action Levels	1578		301,941		NA		NA		NA
	Background *	NA		NA		NA		NA		NA

Notes:
MW = Monitor Well
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
DCM = Dichloromethane
TPH = Total Petroleum Hydrocarbon
NA = Not available or applicable
* = Background groundwater values taken from monitor well 09-MW-05
Concentrations expressed as micrograms per liter (ug/l) except for TPH
Concentrations for TPH expressed as milligrams per liter (mg/l)

3.6.4 SUMMARY

The field screening and laboratory analyses of samples collected from Site No. 7 indicated an area of soil contamination, downgradient of the oil-water separator, that may have contributed to groundwater contamination. The source of this contamination could be the oil-water separator, surface runoff, or the buried gasoline tank.

Drainage from Site No. 7 has probably also contributed to the contamination of the drainage ditch north of the site. In the drainage ditch, TPH was detected in the sediments at concentrations up to 658 mg/kg. The source of this contamination appears to be direct discharge from the washrack; however, an upstream or background sample was not obtained to confirm the source of the TPH contamination. Use of the oil-water separator could impact the quality of the ditch yielding significantly different results than those presented here.

3.7 SITE NO. 8--OLD 165TH AIRCRAFT WASHRACK

3.7.1 TOPOGRAPHY AND HYDROGEOLOGY

Most of the site is on a filled section of the Savannah International Airport. The parking ramp appears to be approximately 6 feet above the natural grade at an elevation of approximately 42 feet NGVD. From the edge of the paved ramp, there is an abrupt decline of 6 to 10 feet to the south and the east.

The site's pavement drains to the southeast and is collected by a series of stormwater drains. The drains merge into a central collection line that ultimately discharges into the drainage ditch. Although there is a curb on the eastern edge of the pavement, surface water probably runs off the southern edge and percolates into the surrounding soils.

The drainage ditch that parallels the eastern site boundary is relatively large and receives surface water drainage from the surrounding pavements and roadways. The ditch was observed intercepting groundwater flow through "seeps" entering the ditch. The ditch ranges from 6 to 10 feet in width and from 6 inches to 2 feet in depth. A slow and constant flow was observed in the ditch, although local velocities varied with the cross sectional area of the ditch. The drainage ditch continues to flow to the southeast as it leaves the base and eventually discharges into Pipemakers Canal, approximately 1 mile from the site.

Soil profiles were prepared during the installation of three soil borings and four well borings. Under the pavement at Site No. 8, there is approximately 6 feet of fill material. This material is a poorly graded sand that ranges in color from dark brown to light brownish gray. The material is very dense and in areas contains substantial

quantities of pine roots. Below the fill layer, there is a layer of poorly graded sands to approximately 11 feet bls. The sands are medium to dark brown and fairly loose. Along the southern edge of the pavement, organic sands were encountered between 10 and 12 bls. In the center of the ramp area, a light brown sandy clay was encountered to approximately 16 feet bls.

In the areas surrounding Site No. 8, a poorly graded clean sand was encountered to approximately 6 feet bls. The surficial sands ranged in color from gray to dark brown. Below this layer, a clayey sand with silty sand was encountered. This layer was present at the approximate location of the groundwater surface. This material ranged in color from grayish brown to dark gray and had varying degrees of plasticity, silt content, and seams of sand. At 10 to 12 feet bls, a well-graded sand layer was encountered. This sand appeared highly permeable, very dense, and ranged in color from dark gravish brown to light brownish gray.

The groundwater surface across the site followed the topography and ranged from 4 to 11 feet bls. On July 13, 1990, a surface water elevation was measured at Site No. 8 and groundwater measurements were taken at three piezometers installed at Site No. 10, approximately 200 yards northwest. An average gradient of 0.019 feet per foot to the east-northeast was estimated.

A second set of groundwater measurements was collected on October 3, 1990. This data set consisted of measurements from the piezometers at Site No. 10, the surface water elevations at Site No. 8, and 5 monitor wells installed at Site No. 8 and Site No. 10. Figure 3-11 shows the contours produced using the data collected on October 3, 1990. This figure basically confirms the original contour patterns, but depicts them with a higher degree of resolution around the ditch. From these contours, an average gradient of 0.04 feet per foot to the north-northwest was estimated.

One slug test was performed at Site No. 8 in Monitor Well 08-MW-03. This test yielded a value of approximately 19.22 fpd (6.78 x 10^{-3} cm/s) for hydraulic conductivity. This value appears consistent with other values across the base and with visual observations made during the soil profiles.

Using the projected flow gradient of 0.04, the estimated hydraulic conductivity of 19.22 fpd (6.78 x 10^{-3} cm/s), and an assumed porosity value of 0.40, an average groundwater flow velocity of 1.92 fpd across the site was estimated. This value is very high and may only be applicable in isolated areas.

3.7.2 FIELD-SCREENING RESULTS

Field-screening activities at this site consisted of conducting an SOV survey and screening soil samples collected during the installation of three soil borings. The SOV survey sampled 25 points, plus 3 duplicates, around the perimeter of Site No. 8. The

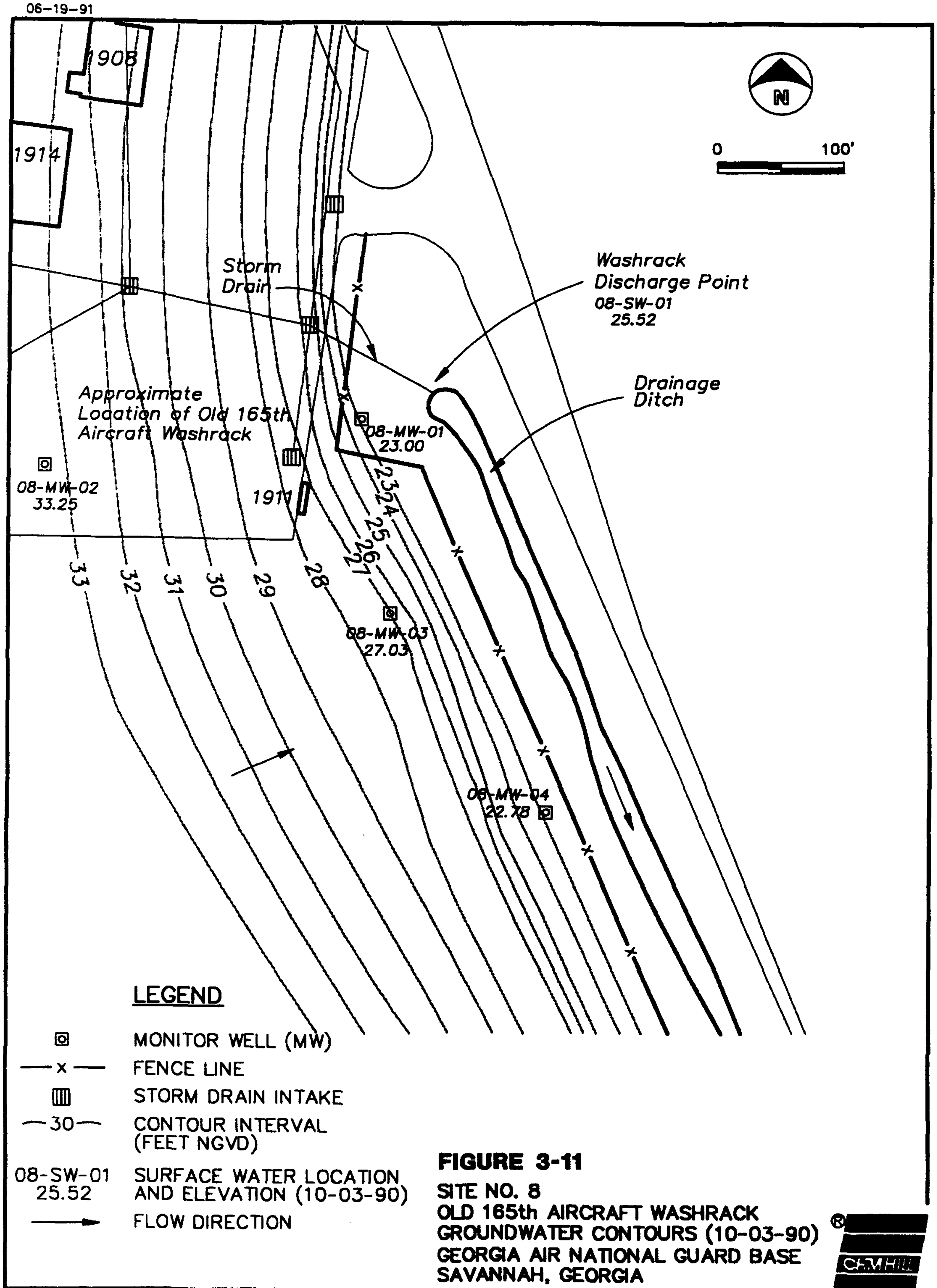

FIGURE 3-11

SITE NO. 8
OLD 165th AIRCRAFT WASHRACK
GROUNDWATER CONTOURS (10-03-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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survey concentrated on the grassy areas east and south of the pavement. The locations of these sampling points are shown in Figure 2-6. Of these sampling points, nine points indicated elevated levels of the five target compounds. These points were in the grassed area surrounding the pavement and the area between the pavement and the point of discharge to the drainage ditch.

Following the SOV survey, three soil borings were installed near accessible areas. The three soil borings were installed near SOV Sampling Points 08-SG-23, 08-SG-19, and 08-SG-13. Two samples were collected at each soil boring for head-space analysis using the field gas chromatograph. The first soil sample was collected from ground surface to 2 feet bls, and the second sample was collected near the soil/groundwater interface. The field screening indicated low levels of the target compounds at Soil Borings 08-SB-01 and 08-SB-02. The compounds were detected in higher concentrations in the lower soil sample from Soil Boring 08-SB-01 and the upper soil sample from Soil Boring 08-SB-02.

Field screening using SOV techniques proved successful at Site No. 8. Not only did the gas chromatograph indicate the presence of excessive contamination near 08-SB-03, it also detected trace quantities of VOCs near the locations of 08-SB-01 and 08-SB-02. Confirmatory sampling of the three boring locations verified the results of the SOV investigation. Although SOV indicated the presence of VOC target compounds, it overestimated the concentrations of the contaminants actually present in the soil. The reason for this overestimation may be the migration of soil vapors from areas of very high concentrations or contributions from background air quality.

3.7.3 LABORATORY-ANALYSES RESULTS

Laboratory analyses were performed on soil samples collected from the three soil borings, four groundwater samples collected from the monitor wells, four surface water samples collected from the drainage ditch, and six sediment samples collected from the soils at the base of the drainage ditch. Figure 3-12 shows the locations of these samples. These samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. Tables 3-9A, 3-9B, 3-10A, 3-10B, 3-11A, and 3-11B show the analytical results. Monitor Well 08-MW-02 was installed upgradient of the site.

The analyses of the soil samples detected a variety of volatile compounds. The analysis of each of the samples confirmed the volatile contamination observed during the field screening. 1,1,1-Trichloroethane, trichloroethene, 1,1,2-trichloroethane, 1,4-dichlorobenzene, 1,2-dichlorobenzene, and toluene were detected in concentrations ranging from 1.4 μg/kg to 5.6 μg/kg. Samples collected from Soil Boring 08-SB-01 had the highest levels as anticipated from the field screening task; however, some contamination was observed in samples from the other two soil borings. TPH compounds were also detected at elevated concentrations in the upper soil samples collected from Soil Borings 08-SB-02 and 08-SB-03. Chromium, lead, mercury, nickel, and zinc were detected above the detection limits.

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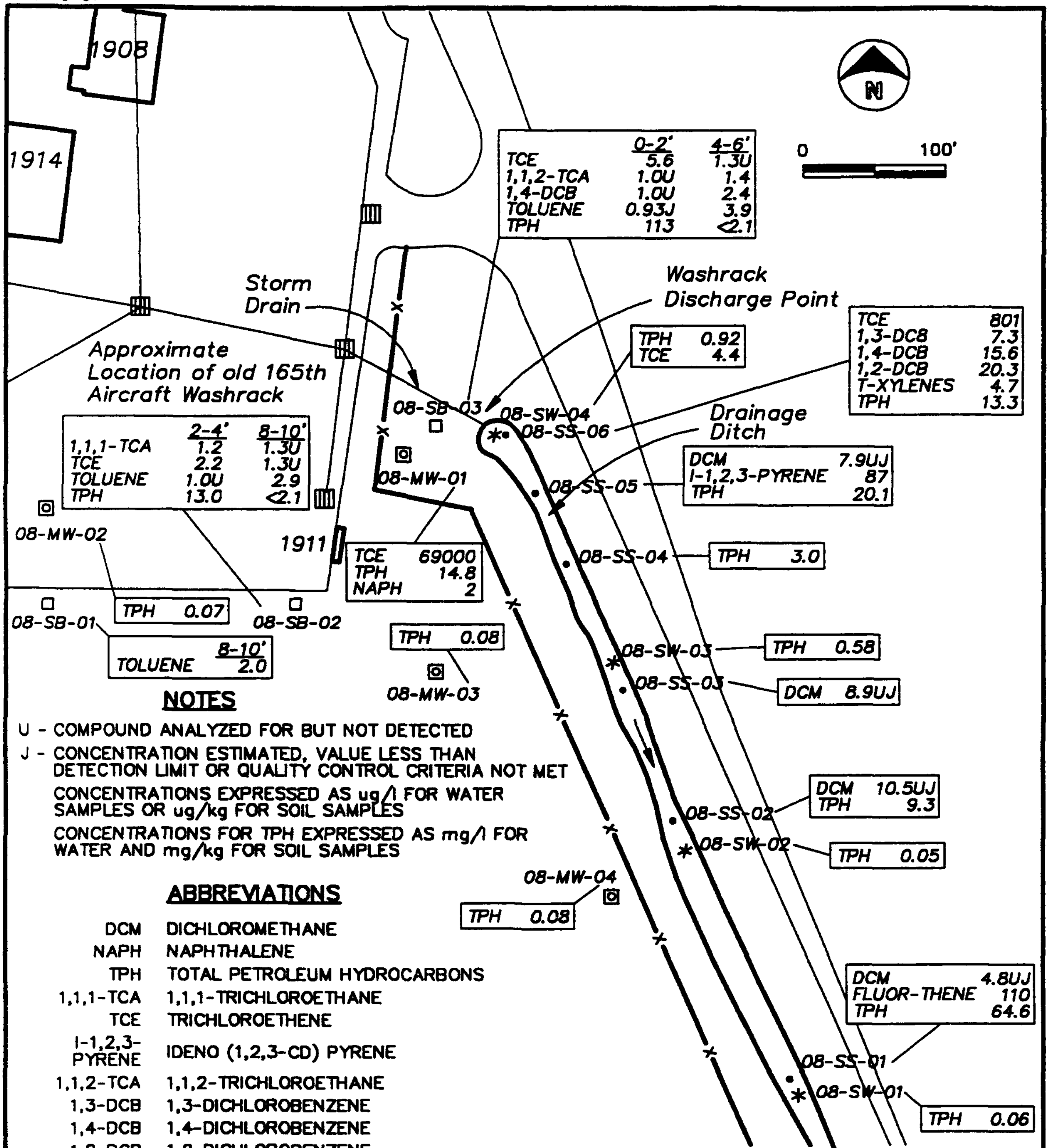

NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM	DICHLOROMETHANE
NAPH	NAPHTHALENE
TPH	TOTAL PETROLEUM HYDROCARBONS
1,1,1-TCA	1,1,1-TRICHLOROETHANE
TCE	TRICHLOROETHENE
I-1,2,3-PYRENE	IDENO (1,2,3-CD) PYRENE
1,1,2-TCA	1,1,2-TRICHLOROETHANE
1,3-DCB	1,3-DICHLOROBENZENE
1,4-DCB	1,4-DICHLOROBENZENE
1,2-DCB	1,2-DICHLOROBENZENE
T-XYLENE	TOTAL XYLENES
FLUOR-THENE	FLUORANTHENE

LEGEND

□	SOIL BORING (SB)
⊡	MONITOR WELL (MW)
•	SEDIMENT SAMPLE (SS)
*	SURFACE WATER SAMPLE (SW)
▥	STORM DRAIN INTAKE
—x—	FENCE LINE
→	FLOW DIRECTION

FIGURE 3-12

SITE NO. 8
OLD 165th AIRCRAFT WASHRACK
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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TABLE 3-9A
SUMMARY OF VOC ANALYSES FOR SOIL/SEDIMENT
SITE NO. 8 - OLD 165TH AIRCRAFT WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Vinyl Chloride	DCM	1,1-DCA	1,1,1-TCA	TCE	1,1,2-TCA	1,3-DCB	1,4-DCB	1,2-DCB	Toluene	Total Xylenes
I. Soil Boring Samples											
08-SB-01 (0-2'bls)	1.1 UJ	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
08-SB-01 (8-10'bls)	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	2.0	1.2 U
08-SB-02 (0-2'bls)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
08-SB-02 (2-4'bls)	1.0 UJ	1.0 U	1.0 U	1.2	2.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
08-SB-02 (8-10'bls)	1.3 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	2.9	1.3 U
08-SB-03 (0-2'bls)	1.0 UJ	1.0 U	1.0 U	1.0 U	5.6	1.0 U	1.0 U	1.0 U	1.0 U	0.93 J	1.0 U
08-SB-03 (4-6'bls)	1.3 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.4	1.0 J	2.4	2.0 J	3.9	1.0 U
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
III. Sediment Samples											
08-SS-01	1.2 UJ	4.8 UJ	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
08-SS-02	1.3 UJ	10.5 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
08-SS-03	1.3 UJ	8.9 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
08-SS-04	1.3 UJ	7.9 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
08-SS-05	1.3 UJ	7.9 UJ	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
08-SS-06	10.3 J	7.9 UJ	2.9 J	44.3 J	801	1.2 U	7.3	15.6	20.3	1.6 J	4.7
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

bls = Below Land Surface
SB = Soil Boring
SW = Surface Water
SS = Sediment Sample
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
J = Concentration estimated because quality control criteria were not met or amount was below detection limit.
NA = Not available or applicable
NS = Not sampled and analyzed
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls)
Concentrations expressed as micrograms per kilogram (ug/kg)

DCM = Dichloromethane
1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethene
1,1,2-TCA = 1,1,2-Trichloroethane
1,3-DCB = 1,3-Dichlorobenzene
1,4-DCB = 1,4-Dichlorobenzene
1,2-DCB = 1,2-Dichlorobenzene

TABLE 3-9B
SUMMARY OF VOC ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 8 – OLD 165TH AIRCRAFT WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	TCE	
I.	Groundwater Samples		
	08-MW-01	69000	
	08-MW-02	1.0	U
	08-MW-03	1.0	U
	08-MW-04	1.0	U
	Action Levels	5	
	Background *	1.0	U
II.	Surface Water Samples		
	08-SW-01	1.0	U
	08-SW-02	1.0	U
	08-SW-03	1.0	U
	08-SW-04	4.4	
	Action Levels	80.7	
	Background *	NA	

Notes:

MW = Monitor Well
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
J = Concentration estimated because quality control criteria were not met or amount was below detection limit.
NA = Not available or applicable
* = Background groundwater values taken from monitor well 09-MW-05
Concentrations expressed as micrograms per liter (ug/l)

TABLE 3-10A
SUMMARY OF PAH AND TPH ANALYSES FOR SOIL/SEDIMENT
SITE NO. 8 - OLD 165TH AIRCRAFT WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Phenan-threne	Anthracene	Fluoran-thene	Pyrene	Benzo(a) anthracene	Chrysene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(a) Pyrene	Ideno(1,2,3 -cd)pyrene	TPH
I. Soil Boring Samples											
08-SB-01 (0-2'bls)	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	<1.8
08-SB-01 (8-10'bls)	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	<1.9
08-SB-02 (0-2'bls)	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	13.0
08-SB-02 (8-10'bls)	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	<2.1
08-SB-03 (0-2'bls)	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	113
08-SB-03 (4-6'bls)	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	<2.1
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	56 U	13.1
II. Sediment Samples											
08-SS-01	71 U	71 U	110	71 U	71 U	71 U	71 U	71 U	71 U	71 U	64.6
08-SS-02	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	9.3
08-SS-03	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	65 U	<2.2
08-SS-04	68 U	68 U	68 U	68 U	68 U	68 U	68 U	68 U	68 U	68 U	3.0
08-SS-05	55 J	63 U	72 J	51 J	63 U	63 U	63 U	63 U	63 U	87 J	20.1
08-SS-06	3200 J	780 J	2900 J	2800 J	1100 J	1600 J	730 J	480 J	930 J	860 J	13.3
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
U - Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
NA = *Not available or applicable*
TPH = Total Petroleum Hydrocarbon
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls)
Concentration expressed as micrograms per kilogram (ug/kg) except for TPH.
Concentration for TPH expressed as milligrams per kilogram (mg/kg).

TABLE 3-10B

SUMMARY OF PAH AND TPH ANALYSES FOR GROUND/SURFACE WATER

SITE NO. 8 - OLD 165TH AIRCRAFT WASHRACK

GEORGIA AIR NATIONAL GUARD BASE

SAVANNAH, GEORGIA

	Sample	Naphthalene		TPH
I.	Groundwater Samples			
	08-MW-01	2		14.8
	08-MW-02	2	U	0.07
	08-MW-03	2	U	0.08
	08-MW-04	2	U	0.08
	Action Levels	NA		NA
	Background *	2	U	<0.06
II.	Surface Water Samples			
	08-SW-01	2	U	<0.06
	08-SW-02	2	U	<0.05
	08-SW-03	2	U	0.58
	08-SW-04	2	U	0.92
	Action Levels	NA		NA
	Background *	NA		NA

Notes:

MW = Monitor Well

SW = Surface Water

U - Compound was analyzed for but not detected. Numerical value is the estimated detection limit

NA = Not available or applicable

TPH = Total Petroleum Hydrocarbon

* = Background groundwater values taken from monitor well 09-MW-05

Concentration expressed as micrograms per liter (ug/l) except for TPH

Concentration for TPH expressed as milligrams per liter (mg/l) for water samples.

TABLE 3-11A
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR SOIL/SEDIMENT
SITE NO. 8 - OLD 165TH AIRCRAFT WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
I. Soil Boring Samples											
08-SB-01 (0-2'bls)	<0.53 J	<0.53	<0.53	4.7	<1.1	<2.6	<0.02	3.2	<1.3 J	<1.0	1.0
08-SB-01 (8-10'bls)	<0.60 J	<0.60	<0.60	<3.0	<1.2	<3.0	<0.02	<3.0	<1.5 J	<1.2	1.8
08-SB-02 (0-2'bls)	<0.53 J	<0.53	<0.53	7.4	<1.1	19.0	<0.02	2.6	<1.3 J	<1.0	1.6
08-SB-02 (8-10'bls)	<0.63 J	<0.63	<0.63	8.8	<1.3	5.0	0.07	<3.1	<1.6 J	<1.2	0.63
08-SB-03 (0-2'bls)	<0.51 J	<0.51	<0.51	<2.6	<1.0	2.6	<0.02	<2.6	<1.3 J	<1.0	<0.51
08-SB-03 (4-6'bls)	<0.63 J	<0.63	<0.63	8.2	<1.3	4.4	<0.02	<3.2	<1.6 J	<1.2	0.63
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	4.0	<0.56	<0.56	15.6	<1.1	3.9	<0.02	<2.8	<1.4	<1.1	3.9
III. Sediment Samples											
08-SS-01	1.3 J	<0.60	1.3	6.8	4.6	21.2	0.46	<4.6	<0.60 J	<1.1	59.6
08-SS-02	0.62 J	0.62	0.06	17.7	<2.5	16.7	0.04	<4.9	<0.60 J	<1.2	6.2
08-SS-03	0.78 J	0.78	0.03	21.5	3.9	21.3	0.07	<5.2	<0.65 J	<1.3	5.2
08-SS-04	0.92 J	0.66	0.12	19.9	<2.6	18.9	0.07	<5.2	<0.65 J	<1.3	5.2
08-SS-05	0.64 J	<0.64	0.04	23.0	3.8	25.7	0.13	<5.1	<0.64 J	<1.3	59.0
08-SS-06	0.84 J	<0.60	0.12	26.0	2.4	17.1	0.07	<4.8	<0.60 J	<1.2	6.0
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	7.4	0.85	1.7	52	22	17	0.12	18	NA	NA	52

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
NA = Not available or applicable
J = Concentration estimated because *quality control criteria not met or amount detected was below detection limit.*
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls). Background values
for sediment taken from U.S. Geologic Survey (1984).
Antimony and Thallium *were analyzed for, but neither detected*
Concentrations expressed as milligrams per kilogram (mg/kg)

TABLE 3-11B
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 8 - OLD 165TH AIRCRAFT WASHRACK
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Groundwater Samples											
08-MW-01	<0.005	<0.005	0.0007	0.065	0.02	<0.002	0.108	0.0005	<0.04	<0.01	0.03
08-MW-02	<0.005	0.005	<0.0002	0.083	0.08	NS	0.133	0.0009	<0.04	<0.01	0.03
08-MW-03	0.008	0.008	0.0008	0.234	0.04	NS	0.135	0.0011	<0.04	<0.01	0.09
08-MW-04	0.007	0.01	0.0003	0.170	0.10	NS	0.097	0.0014	<0.04	0.01	0.08
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.05	NA
Background *	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.022	0.0003	<0.04	0.011	0.08
II. Surface Water Samples											
08-SW-01	<0.005 J	0.01	0.0005	0.003 J	<0.02	NS	0.006 J	<0.0002	<0.04	<0.01	0.04
08-SW-02	<0.005 J	0.01	0.0009	0.002 J	0.02	NS	0.005 J	<0.0002	<0.04	<0.01	0.04
08-SW-03	<0.005 J	<0.005	0.0009	0.003 J	0.02	NS	0.004 J	<0.0002	<0.04	<0.01	0.04
08-SW-04	<0.005 J	<0.005	0.0010	0.003 J	0.02	0.002 J	0.005 J	<0.0002	<0.04	<0.01	0.03
Action Levels	0.050	0.001	0.0011	0.210	0.012	NA	0.0032	0.00001	0.160	0.00012	0.110
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
MW = Monitor Well
SW = Surface Water
F = Filtered sample
UF = Unfiltered sample
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria not met or amount detected was below detection limit.
* = Background groundwater values taken from monitor well 09-MW-05
Antimony and Thallium were analyzed for, but neither was found in samples.
Concentrations expressed as milligrams per liter (mg/l) for water samples and milligrams per kilogram (mg/kg) for soil samples.

Groundwater samples were collected from each of the four monitor wells at Site No. 8. In the sample from Monitor Well 08-MW-01, installed near Soil Boring 08-SB-01, strong chemical odors were noted, TCE was detected at 69,000 μg/l, and naphthalene was detected at 2 μg/l. Dichloromethane, a suspected laboratory artifact due to its use in sample extraction, was detected at 1 μg/l in the sample from Monitor Well 08-MW-03. All other VOC and PAH data were below detection limits. Monitor Well 08-MW-02 installed upgradient of the site did not contain VOC or PAH contamination. TPH was measured at 14.8 mg/l in the sample from Monitor Well 08-MW-01, and between 0.07 and 0.08 in the samples from the other three wells. Arsenic, beryllium, cadmium, chromium, copper, lead, mercury, and zinc were measured above the detection limits in the groundwater samples. Lead was measured in the unfiltered sample from Monitor Well 08-MW-01 at 0.108 mg/l, but was less than 0.002 mg/l in the filtered sample.

In the surface water samples collected from the drainage ditch, TCE was detected at 4.4 μg/l in the sample collected at the drainage ditch discharge point (08-SW-04). Beryllium, cadmium, chromium, copper, lead, and zinc were measured above the detection limits in the surface water sample. Lead was measured at 0.005 mg/l in the unfiltered sample, but was 0.002 mg/l in the filtered sample.
In sediment samples collected from the base of the drainage ditch, a variety of VOCs, PAH compounds, and metals were detected above detection limits. The sample collected adjacent to the point of discharge contained the highest levels, with the levels decreasing with distance from this point.

3.7.4 SUMMARY

It appears there are several areas of contamination at this site. Within the drainage ditch, surface water had a low level of TCE; however, this situation could change quickly depending on the activities at the washrack. Sediment samples from several locations along the ditch showed elevated levels of VOCs, PAH compounds, and metals. Groundwater and soil around Site No. 8 also appeared to be influenced by previous site uses. Groundwater in the vicinity of the drainage ditch discharge had a confirmed TCE value of 69,000 μg/l. Additionally, surface soil contamination was detected in samples from the south side of the ramp pavement and near the point of discharge into the drainage ditch.

3.8 SITE NO. 9--165th CURRENT FIRE TRAINING AREA

3.8.1 TOPOGRAPHY AND HYDROGEOLOGY

Site No. 9 is a level area covered almost entirely by maintained grass. A perimeter taxiway and abandoned aircraft parking facilities are to the north, west, and south of the site; however, these facilities represent a relatively small percentage of the land

area. There is a natural ground-surface slope to the east across the site. Ground surface elevations ranged from a high of approximately 22 feet NGVD to 20 feet NGVD. Several natural and constructed features interrupt this natural grade, including a swale and a drainage pipe north of the site and a stormwater retention pond to the southeast.

Stormwater flows into the area from the southeast quadrant of the airport property. A drainage divide to the northeast of the Fire Training Area causes surface runoff to enter the swale or the stormwater retention pond. Water that enters the pond evaporates or percolates, and water that enters the swale is transported by a concrete drainage pipe into a ditch. The drainage ditch runs southwest approximately 700 feet and then discharges into Pipemakers Canal.

Soil profiles were prepared from soil and well borings at the site. The lithology of the Fire Training Area showed some uniformity, but some areas have been modified by construction activities. In the areas surrounding the site, there were fairly uniform surface soils. These soils were grayish brown silty fine sands that may contain some clay. The surface soils were dense and may become very hard during dry periods. Throughout this area, surface organics were present; however, no substantial roots were located. Below the surface sands, there was a layer of orange and gray mottled fine sand. This material ranged from medium dense to dense and extended to approximately 2 to 7 feet bls. This layer appeared to be thickest on the south side of the Fire Training Area and become thinner as it dipped to the east and north.

North of the Fire Training Area was a dark gray to pale brown fine sand. This material appeared to be fill used to backfill the excavation around the drainage pipe and to create the grading around the swale. The material was a clean fine sand that ranged in density from medium dense to dense and extended to approximately 4 feet bls. A light gray clayey sand was below the fill material. This sand was medium dense and may demonstrate some plasticity. The clayey sand layer, which was encountered from a depth of approximately 3 feet to 8 feet bls, contained the groundwater surface in most locations.

Underlying the entire site was a clean fine sand. Although this material was predominantly gray, it exhibited hues ranging from light yellow to light blue. The material ranged from loose to medium dense and in most locations extended to 6 feet bls, dipping slightly to the north.

The groundwater surface at this site was relatively near the surface and ranged from approximately 3 to 8 feet bls. On July 13, 1990, groundwater elevations were collected from three piezometers and two surface water bodies at the site. A groundwater surface gradient of approximately 0.0067 feet per foot to the west-southwest was estimated.

On October 3, 1990, a second set of water level measurements was collected from five newly installed monitor wells, the three piezometers, and the two surface water

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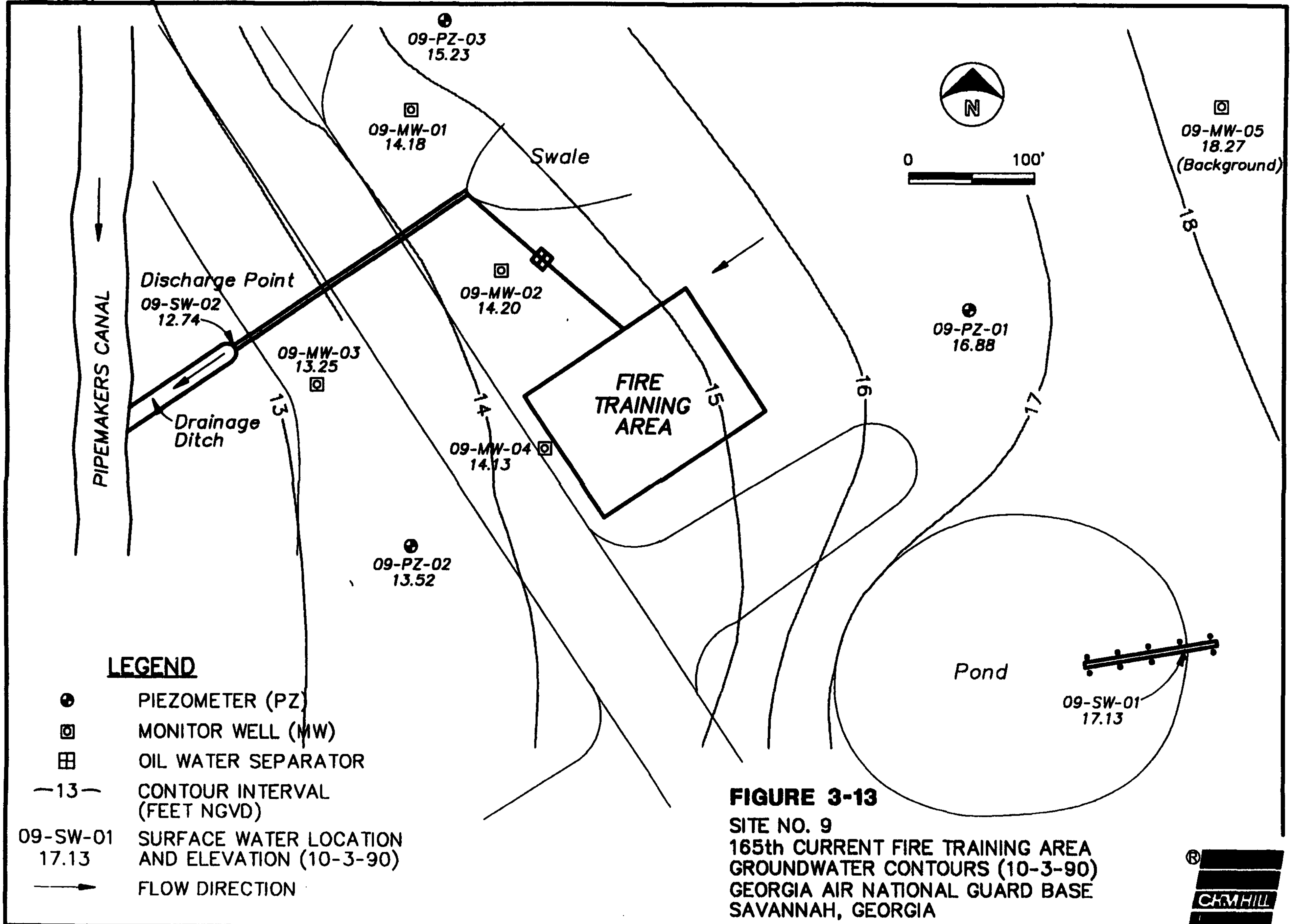

FIGURE 3-13
SITE NO. 9
165th CURRENT FIRE TRAINING AREA
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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bodies. These measurements were used to project the groundwater contours shown in Figure 3-13. The measurements collected on October 3, 1990, confirmed the basic flow direction projected on July 13, 1990, and confirmed the previously estimated gradient of 0.0067 feet per foot.

One slug test was performed at Site No. 9 in Monitor Well 09-MW-04. The slug test yielded a value of approximately 1.82×10^{-1} cm/s for hydraulic conductivity. This value may be more indicative of the gravel pack surrounding the monitor well rather than of the natural soils. Because of the apparent error in the measured hydraulic conductivity value, it may be more accurate to assume a value of 14.17 fpd (5×10^{-3} cm/s), which is similar to that observed at other sites. This value is also more compatible with the observed soil conditions. Using a groundwater gradient of 0.0067, a hydraulic conductivity value of 14.17 fpd, and an assumed porosity value of 0.40, an average groundwater flow velocity of 0.24 fpd to the east-southeast was estimated.

3.8.2 FIELD-SCREENING RESULTS

Field screening activities at Site No. 9 consisted of a 30-point SOV survey and screening of samples collected from five soil borings installed to the approximate depth of the groundwater surface. An SOV survey was performed around the perimeter of the Fire Training Area. Sampling points were chosen somewhat at random around the site with a slightly greater number of sampling points selected near the oil-water separator and swale areas. Because standing water made SOV sampling impossible in the area northeast of the swale, hand-auger borings were performed to collect soil samples for head-space analysis. Figure 2-7 shows the locations of the field screening samples.

In the SOV survey, three detections were observed in Sampling Points 09-SG-02, 09-SG-08 (duplicated by 09-SG-09), and 09-SG-10. These points are near the swale and the oil-water separator, which receive drainage from the Fire Training Area. Near the oil-water separator, toluene, ethyl benzene, and total xylenes were detected. Sampling Point 09-SG-10 contained the highest concentrations of each compound. In three other sampling points (09-SG-06, 09-SG-12, and 09-SG-18), trace quantities of the target compounds were detected. In the head-space and gas- chromatograph analyses of the samples from the four hand-auger borings, including one duplicate sample, some levels of the target compounds were detected.

Five soil borings were performed around the perimeter of the Fire Training Area and near the swale. Two samples from each boring, one from near the ground surface and one from the soil-groundwater interface, were collected and analyzed using the gas chromatograph and head-space techniques. Samples were not collected at Soil Boring 09-SB-04 because of apparent excessive contamination. At this boring, field screening using an hNu indicated levels of total volatile compounds at approximately 100 ppm. The screening of each of the soil samples detected trichloroethene, and

toluene was detected in all samples but the deep soil sample collected from Soil Boring 09-SB-03. Most of the concentrations, however, were low.

SOV at Site No. 9 also met with limited success. Although visible contamination was detected and confirmed near the swale and oil water separator, sampling points in most areas detected low concentrations of VOCs. The reason for these detections may be due to the transmissivity of the soils and the migration of VOC vapors. However, the detection of low concentrations in such a wide area confused the investigation and failed to indicate areas which were actually free from VOC contamination.

3.8.3 LABORATORY-ANALYSES RESULTS

Laboratory analyses were performed on two samples from each of the four soil borings, five groundwater samples, two surface water samples, and one sediment sample collected from the receiving ditch. The locations of these samples and summary of results are shown in Figure 3-14. Monitor Well 09-MW-05 was installed upgradient of Site No. 9. The samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. The results of the analyses are shown in Tables 3-12A, 3-12B, 3-13A, and 3-13B.

Analytical results of the eight soil samples indicated that only one sample (09-SB-05) contained VOCs or PAH compounds above detection levels. However, the surface soil samples collected from Soil Borings 09-SB-01, 09-SB-03, and 09-SB-05 each contained TPH concentrations ranging from 2.4 to 14.1 mg/kg. The detection of TPH compounds may indicate the presence of unidentifiable organic substances that resulted from the decomposition of fuels or other petroleum contamination.

The analyses for priority pollutant metals indicated that several of soil samples also contained elevated levels of metals. In particular, arsenic was detected at 0.4 to 4.0 mg/kg, chromium was detected at 4.2 to 16.3 mg/kg, lead was detected at 3.1 to 7.2 mg/kg, and mercury was detected at 0.02 to 0.03 mg/kg.

In groundwater samples collected from Monitor Wells 09-MW-02, 09-MW-03, and 09-MW-04, volatile and semivolatile compounds were detected. Monitor Well 09-MW-02, located next to the oil-water separator, appeared to contain the highest levels of the analyzed compounds. Monitor Wells 09-MW-01 and 09-MW-05 were installed upgradient to the north and east of the Fire Training Area and, as expected, samples from these wells did not indicate the presence of volatile or semivolatile compounds. Concentrations of priority pollutant metals were also elevated in samples from Monitor Wells 09-MW-02, 09-MW-03, and 09-MW-04. In each of these samples, beryllium, chromium, lead, and zinc were above method detection limits. Lead was detected at 0.013 mg/l in an unfiltered sample from Monitor Well 09-MW-02, but was detected at less than 0.002 mg/l in the filtered sample from the same well.

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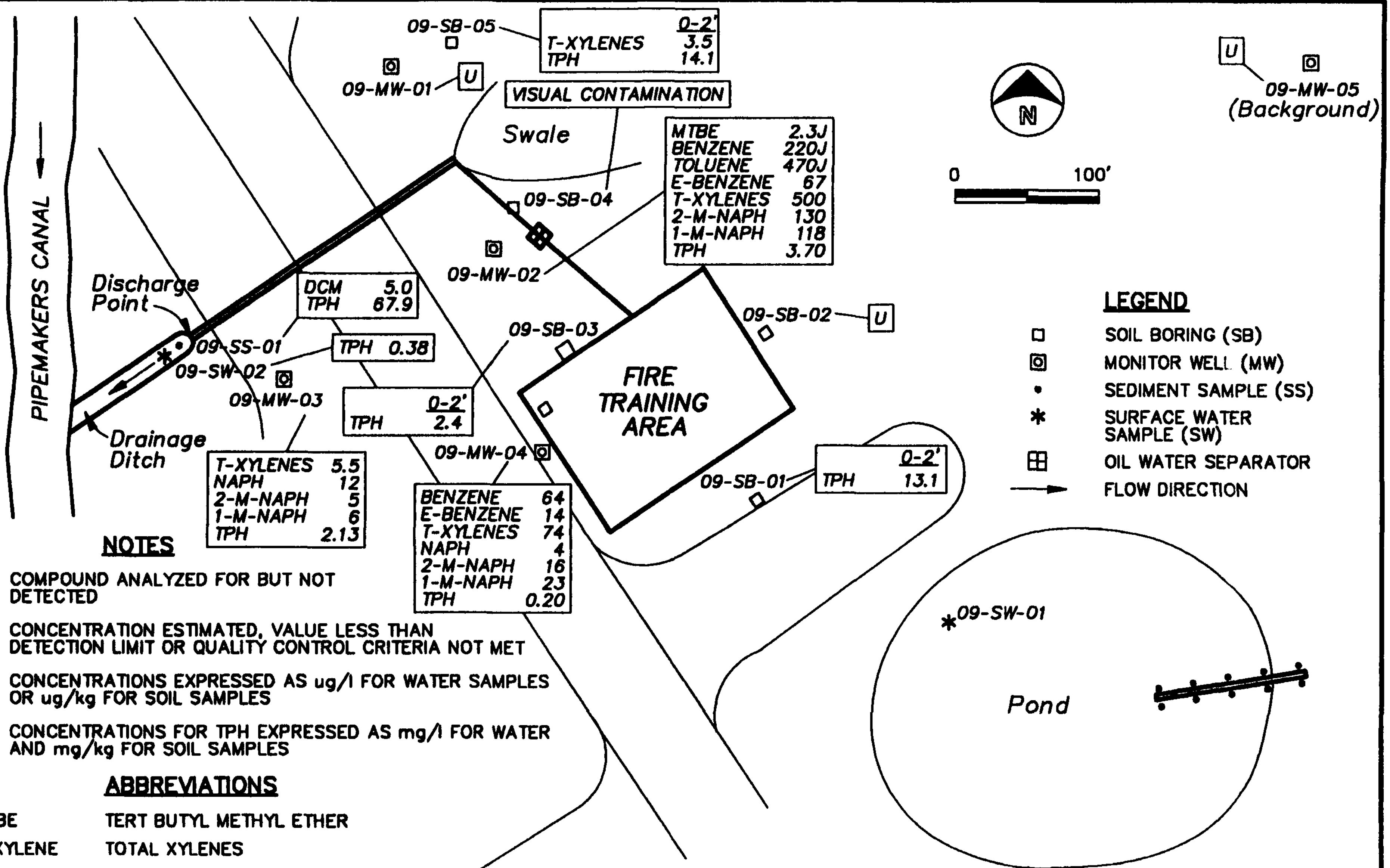

NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

MTBE	TERT BUTYL METHYL ETHER
T-XYLENE	TOTAL XYLENES
E-BENZENE	ETHYL BENZENE
NAPH	NAPHTHALENE
2-M-NAPH	2-METHYL NAPHTHALENE
1-M-NAPH	1-METHYL NAPHTHALENE
DCM	DICHLOROMETHANE
TPH	TOTAL PETROLEUM HYDROCARBONS

FIGURE 3-14

SITE NO. 9
165th CURRENT FIRE TRAINING AREA
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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TABLE 3-12A
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR SOIL/SEDIMENT
SITE NO. 9 - CURRENT FIRE TRAINING AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Naphthalene	2-Methyl Naphthalene	1-Methyl Naphthalene	TPH
I. Soil Boring Samples										
09-SB-01 (0-2'bls)	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	56 U	56 U	56 U	13.1
09-SB-01 (6-8'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	60 U	60 U	60 U	<2.0
09-SB-02 (0-2'bls)	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	51 UJ	51 UJ	51 UJ	<1.7
09-SB-02 (4-6'bls)	NA	NA	NA	NA	NA	NA	60 U	60 U	60 U	<1.9
09-SB-02 (6-8'bls)	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	NA	NA	NA
09-SB-03 (0-2'bls)	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	53 U	53 U	53 U	2.4
09-SB-03 (4-6'bls)	NA	NA	NA	NA	NA	NA	59 U	59 UJ	59 UJ	<1.9
09-SB-03 (6-8'bls)	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	NA	NA	NA	NA
09-SB-05 (0-2'bls)	1.0 U	1.0 U	1.0 U	1.0	1.0 U	3.9	53 U	53 U	53 U	14.1
09-SB-05 (6-8'bls)	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	63 U	63 U	63 U	<2.1
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	56 U	56 U	56 U	13.1
II Sediment Samples										
09-SS-01	5.0	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 U	580 U	580 U	580 U	67.9
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not available or applicable
* = Background soil values taken from soil boring 09-SB-01 (0-2' bls)
DCM = Dichloromethane
MTBE = tert-Butyl methyl ether
TPH = Total Petroleum Hydrocarbon
Concentration expressed as micrograms per kilogram (ug/kg) except for TPH
Concentration for TPH expressed as milligrams per kilogram (mg/kg)

TABLE 3-12B
SUMMARY OF VOC, PAH, AND TPH ANALYSES FOR GROUND/SURFACE WATER
SITE NO. 9 - CURRENT FIRE TRAINING AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Naphthalene	2-Methyl Naphthalene	1-Methyl Naphthalene	TPH
I. Groundwater Samples										
09-MW-01	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	<0.06
09-MW-02	1.0 U	2.3 J	220 J	470 J	67	500	50 U	130	118	3.70
09-MW-03	1.0 U	1.0 UJ	43 J	1.0 J	1.0 U	5.5	12	5	6	0.13
09-MW-04	2.0 UJ	1.1 J	64 J	1.0 U	14	74	4	16	23	0.20
Action Levels	NA	NA	5	NA	NA	NA	NA	NA	NA	NA
Background *	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U	2.0 U	2.0 U	<0.06
II. Surface Water Samples										
09-SW-01	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	<0.06
09-SW-02	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	2 U	2 U	2 U	0.38
Action Levels	NA	NA	71.28	301,941	28,178	NA	NA	NA	NA	NA
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
MW = Monitor Well
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not available or applicable
* = Background groundwater values taken from monitor well 09-MW-05
DCM = Dichloromethane
MTBE = tert-Butyl methyl ether
TPH = Total Petroleum Hydrocarbon
Concentration expressed as micrograms per liter except for TPH
Concentration for TPH expressed as milligrams per liter

TABLE 3-13A
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR SOIL/SEDIMENT
SITE NO. 9 - CURRENT FIRE TRAINING AREA
GEORGIA NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
I. Soil Boring Samples											
09-SB-01 (0-2'bls)	4.0	<0.56	<0.56	15.6	<1.1	3.9	<0.02	<2.8	<1.4	<1.1	3.9
09-SB-01 (6-8'bls)	<0.30	<0.61	<0.61	12.1	1.8	4.9	<0.02	5.5	<1.5	<1.2	1.8
09-SB-02 (0-2'bls)	<0.25	<0.51	<0.51	2.5	2.5	3.1	0.02	<2.5	<1.3	<1.0	1.5
09-SB-02 (4-6'bls)	1.1	<0.59	<0.59	8.3	<1.2	4.7	<0.02	<2.9	<1.5	<1.2	2.9
09-SB-02 (6-8'bls)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
09-SB-03 (0-2'bls)	0.45	<0.53	<0.53	4.2	<1.1	5.8	0.03	2.6	<1.3	<1.0	1.6
09-SB-03 (4-6'bls)	1.9	<0.59	<0.59	12.4	<1.2	5.3	<0.02	4.1	<1.5	<1.2	4.1
09-SB-03 (6-8'bls)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
09-SB-05 (0-2'bls)	0.62	<0.53	<0.53	5.3	<1.1	3.2	0.02	4.2	<1.3	<1.0	1.6
09-SB-05 (6-8'bls)	0.40	<0.60	<0.60	16.3	1.8	7.2	0.02	<3.0	<1.5	<1.2	3.6
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	4.0	<0.56	<0.56	15.6	<1.1	3.9	<0.02	<2.8	<1.4	<1.1	3.9
II. Sediment Samples											
09-SS-01	1.2	<0.62	<0.02	4.7	<2.5	24.0	<0.024	<4.9	<0.62	<1.2	5.6
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background *	7.4	0.85	1.7	52	22	17	0.12	18	NA	NA	52

Notes:
bls = Below Land Surface
SB = Soil Boring
SS = Sediment Sample
NA = Not available or applicable
* = Background values for soil values taken from soil boring 09-SB-01 (0-2' bls). Background values for sediment taken from U.S. Geologic Survey (1984).
Antimony and Thallium were also analyzed for, but neither was detected
Concentrations expressed as milligrams per kilogram (mg/kg)

TABLE 3-13B

SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES FOR GROUND/SURFACE WATER

SITE NO. 9 - CURRENT FIRE TRAINING AREA

GEORGIA NATIONAL GUARD BASE

SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Groundwater Samples											
09-MW-01	<0.005 J	<0.005	0.0002	0.012 J	<0.02	NS	0.010	<0.0002	<0.04	<0.01	0.04
09-MW-02	0.008 J	0.010	0.0013	0.110	0.04	<0.002	0.018	0.0003	<0.04	0.015	0.19
09-MW-03	<0.005 J	0.007	<0.0002	0.048	0.02	NS	0.053	<0.0002	<0.04	<0.01	0.06
09-MW-04	<0.005 J	0.015	<0.0002	0.098	0.06	NS	0.022	0.0003	0.06	0.01	0.13
Action Levels	<0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.05	NA
Background *	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.022	0.0003	<0.04	0.011	0.08
II. Surface Water Samples											
09-SW-01	<0.005	<0.005	<0.0002	<0.002	<0.02	NS	<0.002	<0.0002	<0.04	<0.01	<0.01
09-SW-02	0.007	<0.005	<0.0002	<0.002	<0.02	<0.002	0.003	<0.0002	<0.04	<0.01	<0.01
Action Levels	0.050	0.001	0.0011	0.210	0.012	NA	0.0032	0.00001	0.16	0.00012	0.110
Background *	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
MW = Monitor Well
SW = Surface Water
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
F = Filtered sample
UF = Unfiltered Sample
* = Background groundwater values taken from monitor well 09-MW-05
Antimony and Thallium were also analyzed for, but neither was detected
Concentrations expressed as milligrams per liter (mg/l)

One surface water sample was collected from the discharge ditch and from the stormwater retention pond. VOCs and PAH compounds were below detection limits in both samples. TPH was detected at 0.38 mg/l in the surface water sample from the drainage ditch (09-SW-02). The metals analyses of the surface water samples indicated that compounds were below their respective detection limits with the exception of beryllium, which was detected at a concentration of 7 μg/l in the sample from the stormwater retention pond (09-SW-01).

One sediment sample was also collected from the discharge ditch. In this sample, VOCs and PAH compounds were below detection levels; however, TPH was detected at 67.9 mg/kg. The detection of TPH compounds indicates that other unidentifiable compounds, probably hydrocarbon compounds produced during the degradation of the fuels, are in the sediments. The metals analysis of the sediment sample indicated concentrations of arsenic, chromium, lead, and zinc above detection limits.

3.8.4 SUMMARY

It appears there are several areas of contamination at the Fire Training Area. The first area is in the upper soils between the oil-water separator and the swale. Petroleum based contamination was visually observed in combination with elevated field photo-ionization detector (PID) readings in the sample from Soil Boring 09-SB-04, and the sample from Soil Boring 09-SB-05 had low levels of volatile compounds. The source of this contamination appears to be the discharges flowing from the oil-water separator directly into the swale. The source may also be a possible leak or overflow from the oil-water separator.

Groundwater at this site also appears to have been affected by the activities at the Fire Training Area. Elevated levels of volatile and semivolatile compounds were detected in samples from Monitor Wells 09-MW-02, 09-MW-03, and 09-MW-04, located on the northwest and west sides of the Fire Training Area. The exact source of this contamination is unknown; however, it may be the combined result of a breach in the liner of the burn pit and a leak in the oil-water separator. No VOC or PAH compounds were detected in the upgradient well 09-MW-05.

Surface water at this site does not appear to contain target compounds above detection limit. The pond, located southeast of the Fire Training Area, probably does not receive runoff from the burn pit area, and the drainage ditch is periodically flushed with stormwater. The samples from sediments in the drainage ditch showed elevated levels of TPH. This detection probably indicates a history of petroleum-compound discharges, which degraded into non-target organic compounds. The condition of the drainage ditch could change significantly if a discharge from the oil-water separator occurs.

3.9 SITE NO. 10--BULK CHEMICAL STORAGE AREA

3.9.1 TOPOGRAPHY AND HYDROGEOLOGY

Site No. 10 is in a small unpaved parcel of land surrounded by large tracts of pavement. The area is very flat with ground surface elevations ranging from approximately 17 to 19 feet NGVD. There is a slight depression to the northeast of the facility. Stormwater runs off the surrounding pavement and is collected in a series of drains that discharge to an adjacent ditch. Stormwater that falls directly on the unpaved portion of the site, an area of approximately 400 square feet, either percolates into the groundwater or runs off onto the pavement, depending on the rainfall intensity.

Subsurface conditions of the site were described during the installation of Soil Boring 10-SB-01 and Well Boring 10-WB-01. Soil Boring 10-SB-01 was drilled to the approximate depth of the groundwater surface, and Well Boring 10-WB-01 was drilled to 18 feet, the approximate depth of Monitor Well 10-MW-01. In general, the upper 4 to 5 feet of the areas surrounding Site No. 10 was composed of fill material. These mottled soils ranged in color from tan to black. The fill material was a medium dense fine sand that contained some construction debris, i.e., bricks, tile, and concrete. Below the pavement, this material was slightly moist; however, below the pavement and in the surrounding area, the fill was substantially above the groundwater surface.

A layer of clean fine sand was below the surface fill material. This material was tan to yellowish brown and medium dense. The thickness of this formation varied between 2 to 4 feet and was inclined and thickened to the east. This material appeared undisturbed and natural. Below the native sand layer was a very dense, reddish brown cemented fine sand. This layer is referred to as "hardpan" and has been previously documented in the northeast quadrant of the Savannah International Airport. The hardpan layer was relatively uniform in thickness, approximately 2 feet, and approximately horizontal. This formation was identified between 7 and 9.5 feet bls. A very dense, yellowish brown fine sand was below the hardpan layer. This material contained the groundwater surface and was observed to approximately 14 feet bls. This sand layer appeared moderately permeable and was not cemented.

In Well Boring 10-WB-01, two additional formations were encountered. These included a olive gray sandy silt layer from 14 to 16 feet bls and a light gray fine sand from 16 to 18 feet bls. The sandy silt layer appeared very loose and relatively impermeable, and the sand layer was medium dense and appeared to have a moderately high permeability.

The groundwater surface at Site No. 10 was identified in the yellowish brown, dense fine sands located below the hardpan layer. In all observations, groundwater ranged from 9 to 12 feet bls. On July 13, 1990, water level measurements were collected from three piezometers installed around Site No. 10. These measurements and a

surface water elevation from Site No. 8 were used to estimate the direction of groundwater flow. A relatively steep groundwater surface with a projected gradient of 0.019 feet per foot to the east-southeast was observed.

A second set of measurements was collected on October 3, 1990, to confirm the groundwater flow patterns. The measuring points included the piezometers at Site No. 10, the surface water elevation from Site No. 8, one newly installed well at Site No. 10, and four newly installed wells at Site No. 8. These measurements were used to prepare groundwater contours for Site No. 10, which are shown in Figure 3-15. The contours indicate a gradient of approximately 0.019 feet per foot; however, the direction of groundwater flow, as compared to that projected form the July 13, 1990, data, appears to have shifted slightly to the east.

One slug test was performed at Site No. 10 in Monitor Well 10-MW-01 on October 1, 1990. The test yielded a value of 7.12 fpd (2.51 x 10^{-3} cm/s) for hydraulic conductivity. This value indicates moderate permeability and agrees with the observed soil conditions.

Using the observed groundwater gradient of 0.019, the measured hydraulic conductivity of 7.12 fpd, and an estimated value for porosity of 0.40, an average groundwater velocity was estimated at 0.34 fpd. Groundwater flows across Site No. 10 at this approximate velocity and intercepts the drainage ditch located approximately 100 yards to the southeast.

3.9.2 FIELD-SCREENING RESULTS

Field-screening activities were performed at Site No. 10 to identify areas of excessive contamination. The activities consisted of conducting a limited SOV survey and screening samples from one soil boring.

An SOV survey consisting of five points, including a duplicate sample, was performed in the unpaved portions of the site and the surrounding areas. Figure 2-8 shows the location of field-screening sampling points. The survey indicated the presence of volatile compounds in the area of the bulk chemical storage and in areas to the south. Sampling Points 10-SG-05 and 10-SG-06 were within the chemical storage area. The source of the trichloroethene, benzene, and xylenes detected in the samples from these points may be losses from the storage drums. The lower concentrations of volatile compounds in the other three sampling points may be due to vapor migration under the pavement rather than from a larger area of contamination.

The field screening at Site No. 10 provided very limited information. Although VOC contamination was detected (and later confirmed in the actual storage area), this information could have been provided from observation and screening using a FID or PID. In the areas surrounding the storage area, low concentrations of VOCs were

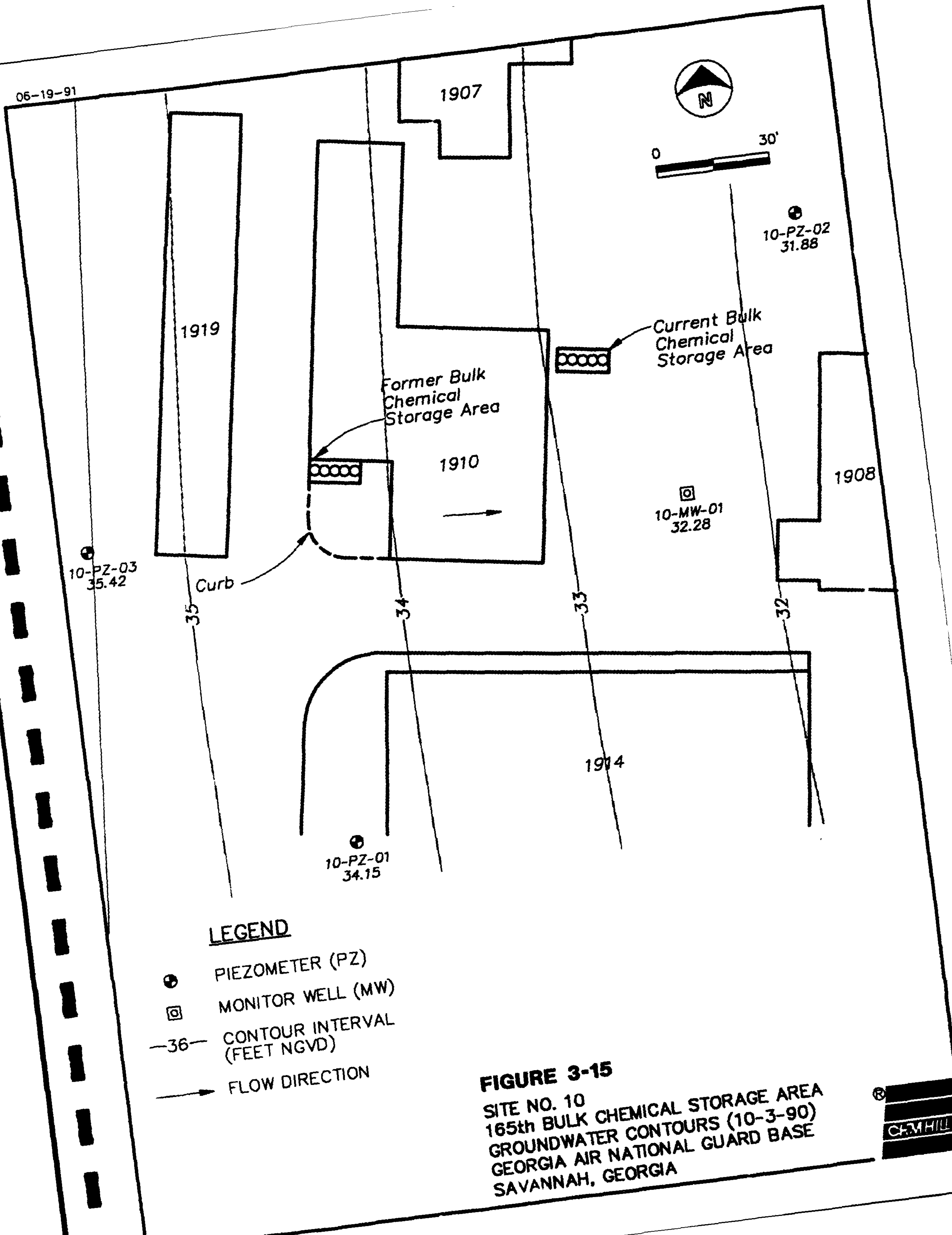


FIGURE 3-15

SITE NO. 10
165th BULK CHEMICAL STORAGE AREA
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

also detected. These detections were not confirmed and probably represent vapor migration under the pavement.

At sites such as this, SOV surveys may be a useful tool to identify "hot spots," however, surface pavements will contain VOC vapors and permit them to travel great distances. A simple screening using a FID or PID may have demonstrated more useful information without the need to collect samples in a more efficient manner.

One soil boring (10-SB-01) was performed near the drum storage area at the site. The boring showed surface staining and had strong odors to approximately 18 inches bls. Two samples were collected from the soil boring at 2 feet bls and near the soil-groundwater interface at 11 feet bls. The samples were analyzed using the field gas chromatograph. High concentrations of trichloroethene and benzene were detected in the upper and lower soil samples, and some total xylenes were detected in the lower soil sample. The analysis also indicated that the concentrations of trichloroethene and benzene were greater in the upper soil sample, which was visually stained.

3.9.3 LABORATORY-ANALYSES RESULTS

Laboratory analyses were performed on samples collected from Soil Boring 10-SB-01 and from Monitor Well 10-MW-01. The locations of these samples is shown in Figure 3-16. These samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. The results of the analyses are shown in Tables 3-14 and 3-15.

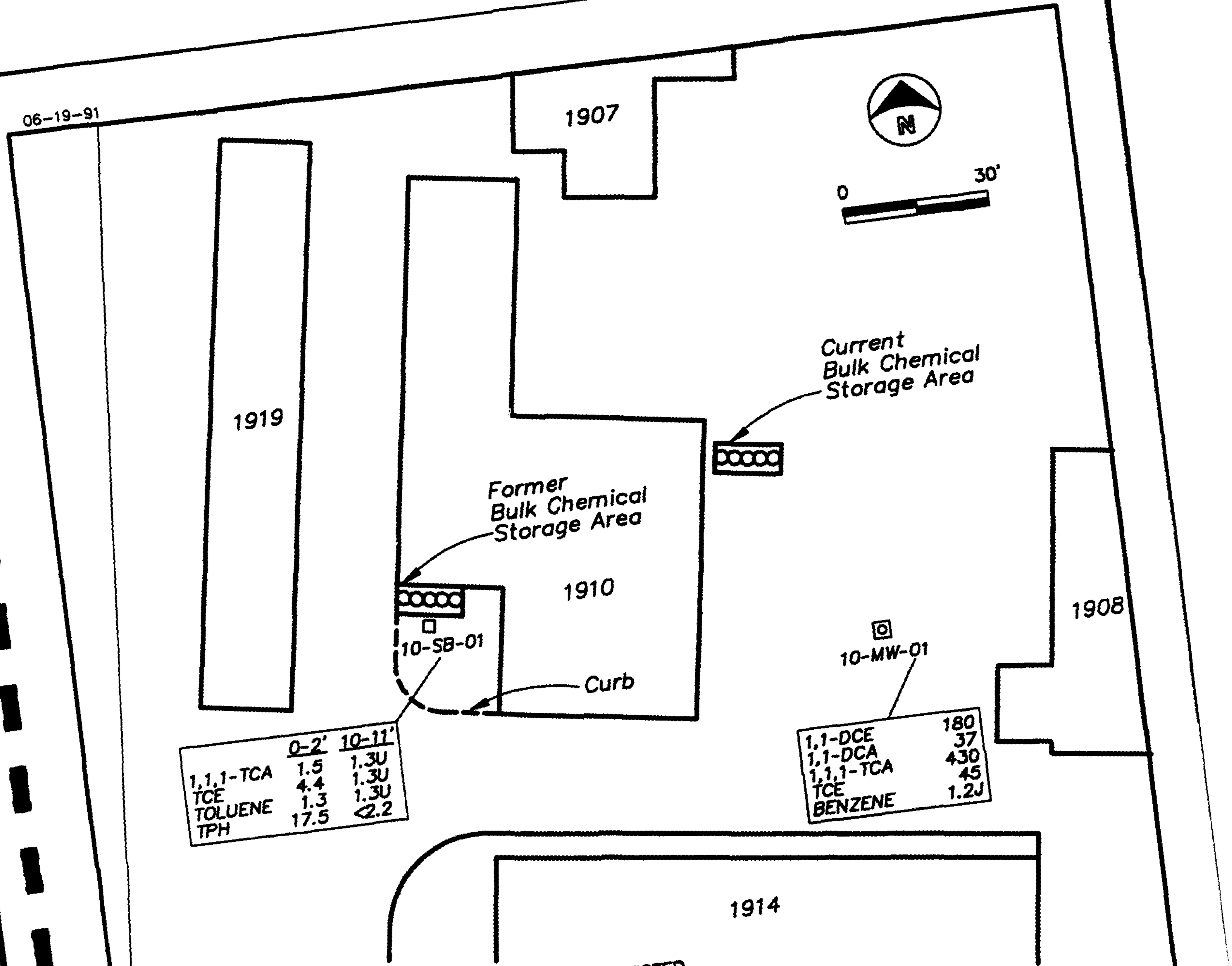
Two soil samples were collected from the soil boring. The upper soil sample, collected from approximately 2 feet bls, had very low concentrations of 1,1,1 trichloroethane, trichloroethene, and toluene. The lower soil sample, collected at 10 to 11 feet bls, did not have detectable concentrations of volatile compounds. Chromium, lead, nickel, and zinc were above the detection limits in both of the samples.

One monitor well was installed and sampled downgradient of Site No. 10. The groundwater sample contained several volatile compounds including trichloroethene and benzene. Beryllium, chromium, copper, lead, and zinc were above their respective detection limits in unfiltered samples. Lead was detected at 0.048 mg/l in the unfiltered sample, but was below 0.002 mg/l in the filtered sample.

3.9.4 SUMMARY

Contamination was detected in the soils and groundwater at Site No. 10. Soil contamination appears to be isolated to the areas that lie directly under the drum storage area. Little vertical migration in the soils was apparent based on laboratory analyses of the deep soil sample. A groundwater sample collected from a monitor well located downgradient from the site contained several volatile compounds.

06-19-91



NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

CONCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

1,1-DCE	1,1 DICHLOROETHENE
1,1-DCA	1,1 DICHLOROETHANE
1,1,1-TCA	1,1,1 TRICHLOROETHANE
TCE	TRICHLOROETHENE
TPH	TOTAL PETROLEUM HYDROCARBONS

LEGEND

□ SOIL BORING (SB)

⊡ MONITOR WELL (MW)

FIGURE 3-16

SITE NO. 10
165th BULK CHEMICAL STORAGE AREA
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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TABLE 3-14
SUMMARY OF VOC, PAH, AND TPH ANALYSES
SITE NO 10 - BULK CHEMICAL STORAGE AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM	1,1-DCE	1,1-DCA	1,1,1-TCA	TCE	Benzene	Toluene	TPH
I. Soil Boring Samples								
10-SB-01 (0-2'bls)	1.1 U	1.1 U	1.1 U	1.5	4.4	1.1 U	1.3	17.5
10-SB-01 (10-11'bls)	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	<2.2
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA
Background*	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	13.1
II. Groundwater Samples								
10-MW-01	1.0 U	180	37	430	45	1.2 J	1.0 U	<0.06
Action Levels	NA	7	NA	200	5	5	NA	NA
Background*	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	<0.06

Notes:
bls = Below Land Surface
SB = Soil Boring
MW = Monitor Well
DCM = Dichloromethane
1,1-DCE = 1,1-Dichloroethene
1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethene
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
TPH = Total Petroleum Hydrocarbon
Concentrations expressed as micrograms per liter (ug/l) for water samples or micrograms per kilogram (ug/kg) for soil samples.
Concentrations for TPH expressed as milligrams per liter (mg/l) for water samples and milligrams per kilogram (mg/kg) for soil samples.
* = *Background soil values taken from soil boring 09-SB-01 (0-2'bls) and*
background groundwater values taken from monitor well 09-MW-05

TABLE 3-15
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES
SITE NO 10 – BULK CHEMICAL STORAGE AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Soil Boring Samples											
10-SB-01 (0-2'bls)	<0.53 J	<0.53	<0.53	7.0	<1.1	NS	7.0	<0.02	<2.7	<1.0	3.7
10-SB-01 (10-11'bls)	<0.66 J	<0.66	<0.66	15.3	2.0	NS	4.7	<0.02	4.0	<1.3	1.3
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	4.00	<0.56	<0.56	15.6	<1.1	NS	3.9	<0.02	<2.8	<1.1	3.9
II. Groundwater Samples											
10-MW-01	<0.010 J	0.006	<0.0002	0.064	0.03	<0.002	0.048 J	<0.0002 J	<0.04	<0.01 J	0.04 J
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.05	NA
Background*	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.022	0.0003	<0.04	0.011	0.08

Notes:
bls = Below Land Surface
SB = Soil Boring
MW = Monitor Well
F = Filtered sample
UF = Unfiltered sample
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
Antimony and Thallium were analyzed for, but neither was detected.
Concentrations expressed as milligrams per liter (mg/l) for water samples and milligrams per kilogram (mg/kg) for soil samples
* = Background soil values taken from soil boring 09-SB-01 (0-2'bls) and
background groundwater values taken from monitor well 09-MW-05

Although these compounds are typically found in solvents stored at Site No. 10, the two soil samples collected at Site No. 10 did not reveal high levels of solvent contamination. Groundwater contamination, however, has been confirmed downgradient from the site, but the extent of the contamination has not been identified.

Local lithology and groundwater properties were adequately defined during this phase of the investigation. The surficial soils and groundwater gradient were defined using data from two soil borings and three piezometers. However, if it is determined that vertical migration of contamination has occurred, additional information may be needed to describe the soil types and properties with depth.

3.10 SITE NO. 11--OLD BURN AREA

3.10.1 TOPOGRAPHY AND HYDROGEOLOGY

The Old Burn Area is a small piece of undeveloped property south of the Gulfstream Aerospace manufacturing facility at the Savannah International Airport. The burn area is approximately 100 feet square. Maintained grass covers the surrounding areas; however, the grass within the burn area appears to show moderate vegetative stress. The site is relatively flat with only localized undulations. A general topographic gradient dipping to the north was apparent; however, surface elevations across the site ranged from only 45 to 46 feet NGVD.

Subsurface soil conditions were documented during the installation of two soil borings and three well borings. In general, a layer of loose to medium dense fine sand extended across the site from ground surface to approximately 4 feet bls. This material was dry and ranged in color from light yellowish brown to greenish gray. Below the surficial sands was a dark reddish brown fine sand. The upper part of this material was weathered and relatively loose. The weathered portion, typically the upper 1 to 2 feet of the formation was underlain by a very dense cemented sand. This formation is referred to as "hardpan" and appears to be consistent with that found at Site No. 10. Hardpan is formed from mineral, apparently iron, cementation of the sand matrix. The resulting material is very hard and may vary in permeability, depending on the degree of cementation and gradation. The groundwater surface was located within the hardpan layer in each of the five soil borings. Below the hardpan layer, a clean medium to dense fine sand layer was encountered. This material ranged in color from yellowish brown to gray and appeared moderately permeable. The base of this material was not identified during this investigation.

The groundwater surface at Site No. 11 was relatively deep compared to the rest of the Savannah International Airport and was observed at between 7 and 10 feet bls. Water level measurements were collected from some of the existing wells at Site No. 11 on July 13, 1990. A gradient of 0.0055 feet per foot to the north-northwest was estimated.

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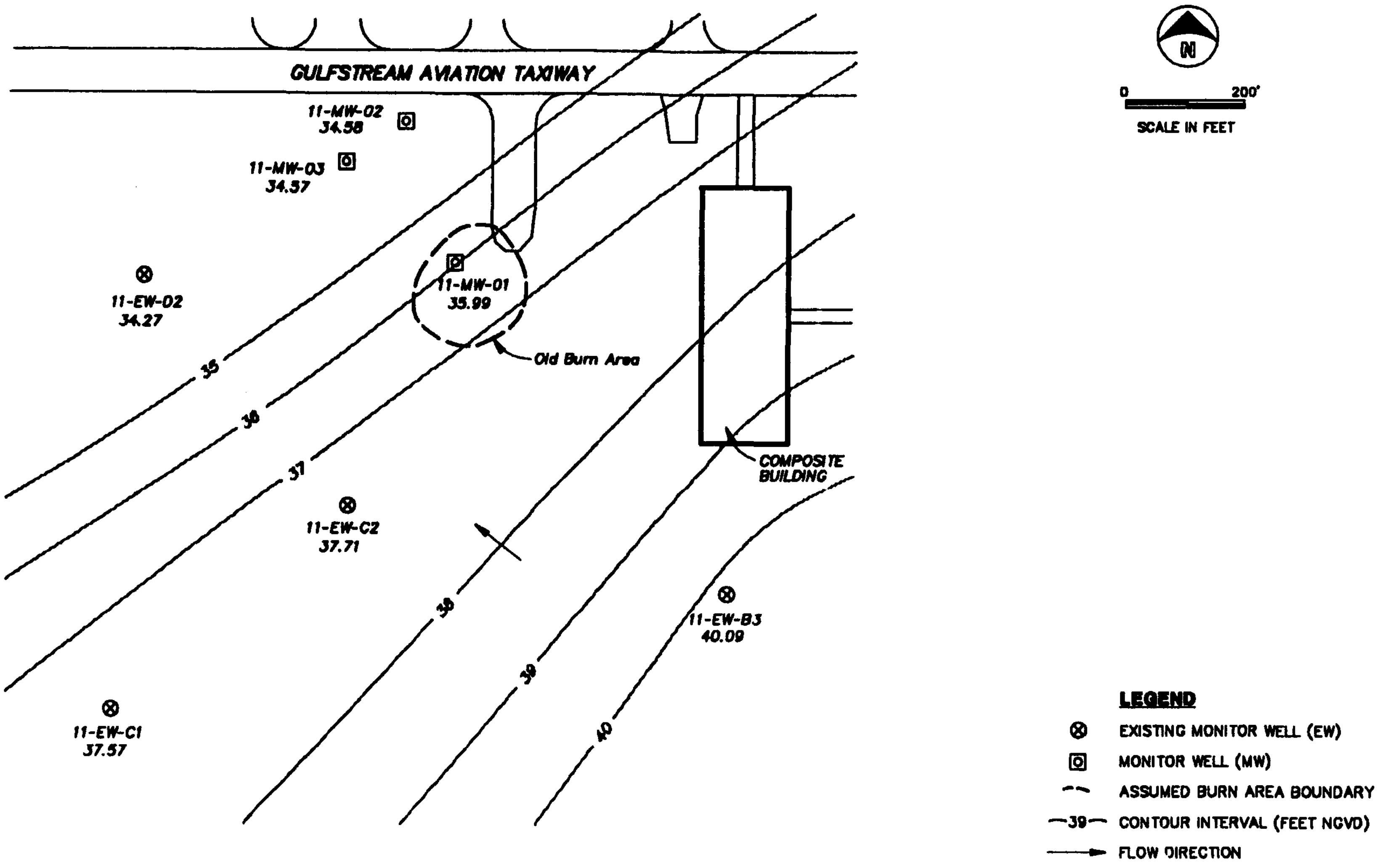

FIGURE 3-17

SITE NO. 11
165th OLD BURN AREA
GROUNDWATER CONTOURS (10-3-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

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Following the installation of three monitor wells at this site, a second set of water level measurements was collected on October 3, 1990, from four existing wells and three new wells at Site No. 11. Figure 3-17 shows the groundwater contours projected using these data. These contours provide a more refined image of the groundwater flow pattern. From these contours, a gradient of 0.0065 feet per foot to the northwest was estimated.

One slug test was performed at Site No. 11 in Monitor Well 11-MW-01. The test yielded a value of 2.41 x 10^{-3} cm/s for hydraulic conductivity. This value appears consistent with the soil types observed and with other regionally produced values. Using the groundwater gradient of 0.0065, the estimated hydraulic conductivity value of 2.41 x 10^{-3} cm/s, and an assumed porosity value of 0.40, an average groundwater flow velocity of 0.11 fpd to the northwest was estimated for the site.

3.10.2 FIELD-SCREENING RESULTS

Field screening was performed at Site No. 11 during a 30-point SOV survey and the installation of two soil borings. The SOV survey was conducted in a random grid pattern around the perimeter of the burn area. Sampling points were shifted to the west based on screening detections. Figure 2-9 shows the locations of the field screening sampling points. The SOV survey identified toluene at a concentration of approximately 100 ppb in virtually every soil gas sample. This detection may be background for the entire area, a residual condition based on the use of the burn area, an anomaly of the field-screening method used at this site or fugitive vapors emanating from airport activities.

Of the SOV points with positive detection, two sample points (11-SG-02 and 11-SG-25) were selected to be screened using soil borings to further delineate contamination. Soil Boring 11-SB-01 was performed in the location of Sample Point 11-SG-02, and volatile contamination was detected at approximately 50 ppm using an hNu. Additionally, two samples were collected for head-space analysis using the field gas chromatograph. No target compounds were detected in the sample collected from ground surface to approximately 2 feet bls. In the lower soil sample, collected at 8 to 10 feet bls, each of the five target compounds was detected. A soil boring was also performed in the location of Sampling Point 11-SG-25. The soil samples collected from this boring did not produce a response on the hNu or yield detectable concentrations on the gas chromatograph.

The use of SOV at Site No. 11 met with limited success. Although the SOV detections lead to the placement of the soil borings, this procedure could have been performed using hand augers and a FID or PID. False detections at this site appeared more wide-spread and also indicated higher concentrations than at other sites. Although this site was closest to active air traffic (and fugitive exhaust vapors), it appears that conditions at this site were not conducive to a SOV survey.

3.10.3 LABORATORY-ANALYSES RESULTS

Laboratory analyses were performed on samples collected from two soil borings, one existing well, and three newly installed wells at Site No. 11. The locations of these samples and summary of results are shown in Figure 3-18. These samples were analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. The results of the analyses are shown in Tables 3-16 and 3-17.

Two soil samples were collected from each soil boring. The first was collected from just below the ground surface, and the second was collected from the approximate depth of the soil groundwater interface. The analyses indicated the presence of TPH and PAH compounds in the samples collected from Soil Boring 11-SB-01. Toluene and TPH were also detected in the upper soil sample collected from Soil Boring 11-SB-02, but in the lower soil sample no organic compounds were detected above detection limits. Chromium, copper, lead, mercury, nickel, and zinc were measured above detection limits.

Groundwater samples were collected from three new wells and one existing well at Site No. 11. Monitor Well 11-EW-B3 is an existing well that was used to describe background conditions. In the sample from this well, no organic compounds were detected above detection limits. Monitor Well 11-MW-01 was installed slightly downgradient from Soil Boring 11-SB-10. Samples from this well contained VOCs, PAH compounds, and TPH. Benzene was detected at 36 µg/l, toluene at 39 µg/l, and total xylenes at about 170 µg/l. In samples from the Monitor Wells 11-MW-02 and 11-MW-03, which were installed downgradient from Monitor Well 11-MW-01, no organic compounds, except dichloromethane, were detected above detection limits. The analyses also indicated the presence of several metals above background conditions. Chromium, copper, lead, mercury, nickel, silver, and zinc were all detected at concentrations above those present in the background well (11-EW-B3). Lead was measured in the unfiltered sample from Monitor Well at 0.112 mg/l, but was 0.003 mg/l in the filtered sample from the same well.

3.10.4 SUMMARY

Ten SOV sampling points with positive detections outlined the borders of the burn pit, and a soil boring installed within the burn area and a monitor well installed downgradient of the burn area confirmed the presence of organic contaminants. It appears that the area below the burn pit was affected by burn pit activities.

Contamination was present in upper and lower soil samples from Soil Boring 11-SB-01. In the downgradient soil boring (11-SB-02), only the upper soil sample contained organic contaminants. Soil contamination consisted primarily of PAH compounds and TPH. The burn area has not been used since 1980, and the volatile components of waste fuel may have evaporated or volatized. In addition, the

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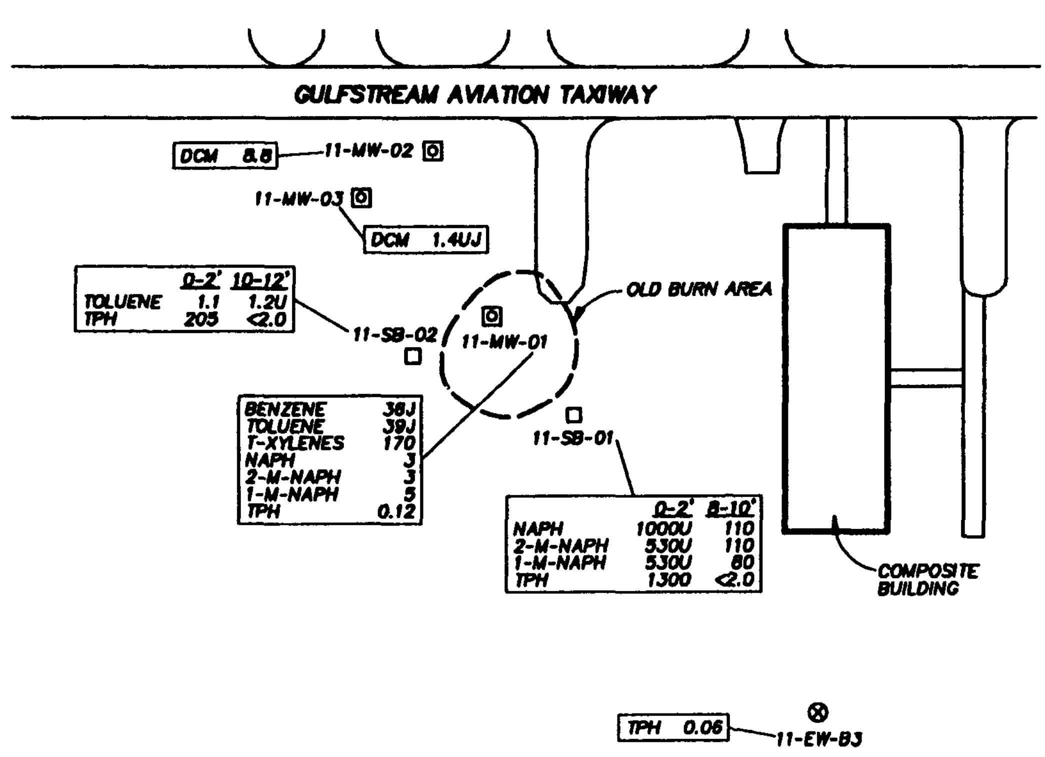

NOTES

U - COMPOUND ANALYZED FOR BUT NOT DETECTED

J - CONCENTRATION ESTIMATED, VALUE LESS THAN DETECTION LIMIT OR QUALITY CONTROL CRITERIA NOT MET

CONCENTRATIONS EXPRESSED AS ug/l FOR WATER SAMPLES OR ug/kg FOR SOIL SAMPLES

COCENTRATIONS FOR TPH EXPRESSED AS mg/l FOR WATER AND mg/kg FOR SOIL SAMPLES

ABBREVIATIONS

DCM	DICHLOROMETHANE
T-XYLENES	TOTAL XYLENES
NAPH	NAPHTHALENE
2-M-NAPH	2-METHYL NAPHTHALENE
1-M-NAPH	1-METHYL NAPHTHALENE
TPH	TOTAL PETROLEUM HYDROCARBONS

LEGEND

- SOIL BORING (SB)
- MONITOR WELL (MW)
- EXISTING MONITOR WELL (EW)
- ASSUMED BURN AREA BOUNDARY

FIGURE 3-18

SITE NO. 11
165th OLD BURN AREA
CONFIRMATORY SAMPLE ORGANIC RESULTS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

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TABLE 3-16
SUMMARY OF VOC, PAH, AND TPH ANALYSES
SITE NO. 11 - *OLD BURN AREA*
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	DCM		Benzene		Toluene		Total Xylenes		Naphthalene		2-Methyl Naphthalene		1-Methyl Naphthalene		TPH
I. Soil Boring Samples															
11-SB-01 (0-2'bls)	1.0	U	1.0	U	1.0	U	1.0	U	1000	U	530	U	530	U	1300
11-SB-01 (8-10'bls)	1.2	U	1.2	U	1.2	U	1.2	U	110		110		80		<2.0
11-SB-02 (0-2'bls)	1.0	U	1.0	U	1.1		1.0	U	51	U	51	U	51	U	205
11-SB-02(10-12'bls)	1.2	U	1.2	U	1.2	U	1.2	U	63	U	63	U	63	U	<2.0
Action Levels	NA		NA		NA		NA		NA		NA		NA		NA
Background*	1.1	U	1.1	U	1.1	U	1.1	U	56	U	56	U	56	U	13.1
II. Groundwater Samples															
11-MW-01	1.0	U	36	J	39	J	170	*	3		3		5		0.12
11-MW-02	8.8		1.0	U	1.0	U	1.0	U	2	U	2	U	2	U	<0.06
11-MW-03	1.4	UJ	1.0	U	1.0	U	1.0	U	2	U	2	U	2	U	<0.05
11-EW-83	1.0	U	1.0	U	1.0	U	1.0	U	2	U	2	U	2	U	0.06
Action Levels	NA		5		NA		NA		NA		NA		NA		NA
Background*	1.0	U	1.0	U	1.0	U	1.0	U	2.0	U	2.0	U	2.0	U	<0.06

Notes:
bls = Below Land Surface
SB = Soil Boring
MW = Monitor Well
EW = Existing Well
DCM = Dichloromethane
U - Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = *Concentration* estimated because quality control criteria were not met or amount detected was below detection limit
TPH = Total Petroleum Hydrocarbon
Concentrations expressed in micrograms per liter (ug/l) for water samples or micrograms per kilogram (ug/kg) for soil samples.
Concentrations for TPH expressed as milligrams per liter (mg/l) for water samples or milligrams per kilogram (mg/kg) for soil samples.
* = Background soil values taken from soil boring 09-SB-01 (0-2'bls) and
background groundwater values taken from monitor well 09-MW-05

TABLE 3-17
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES
SITE NO. 11 - OLD BURN AREA
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Zinc
I. Soil Boring Samples											
11-SB-01 (0-2'bls)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
11-SB-01 (2-4'bls)	<0.52	<0.52	<0.52	<2.6	8.4	NS	14.7	<0.02	<2.6	<1.0	3.1
11-SB-01 (8-10'bls)	<0.61	<0.61	<0.61	11.7	1.8	NS	11.0	0.07	<3.1	<1.2	1.2
11-SB-02 (0-2'bls)	<0.51	<0.51	<0.51	4.0	<1.0	NS	<2.5	<0.02	4.0	<1.0	1.0
11-SB-02(10-12'bls)	<0.62	<0.62	<0.62	9.4	<1.2	NS	6.2	<0.02	6.2	<1.2	0.62
Action Levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Background*	4.0	<0.56	<0.56	15.6	<1.1	NS	3.9	<0.02	<2.8	<1.1	3.9
II. Groundwater Samples											
11-MW-01	<0.010	<0.005	0.0004	0.099	0.06	0.003 J	0.112 J	<0.0002	<0.04	0.013 J	0.08 J
11-MW-02	<0.010	0.006	<0.0002	0.101	0.07	NS	0.061 J	<0.0002	0.08	0.012 J	0.09 J
11-MW-03	<0.010	0.005	<0.0002	0.128	0.09	NS	0.080 J	0.0009	0.09	0.010 J	0.07 J
11-EW-B3	<0.010	<0.005	<0.0002	0.008	<0.02	NS	0.007 J	<0.0002	<0.04	<0.01 J	<0.01 R
Action Levels	0.05	NA	0.010	0.05	NA	NA	0.05	0.002	NA	0.05	NA
Background*	<0.005 J	0.012	0.0005	0.074	0.06	NS	0.022	0.0003	<0.04	0.011	0.08

Notes:
bls = Below Land Surface
SB = Soil Boring
MW = Monitor Well
EW = Existing Well
F = Filtered sample
UF = Unfiltered sample
NS = Not Sampled
NA = Not available or applicable
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
R = Quality control indicates data not usable.
Antimony and Thallium were analyzed for, but were not detected in samples.
Concentrations expressed as milligrams per liter (mg/l) for water samples or as milligrams per kilogram (mg/kg) for soil samples
* = Background soil values taken from soil boring 09-SB-01 (0-2'bls) and
background groundwater values taken from monitor well 09-MW-05

contamination detected in the upper soil sample collected from the downgradient boring may be the result of surface runoff.

The sample from the monitor well installed just downgradient of the burn pit had elevated levels of VOCs, PAH compounds, and TPH. Although clean background and downgradient wells were established, the extent and dimensions of the plume have not been identified.

3.11 BASEWIDE HYDROGEOLOGY

The following subsections describe GANGB's local lithology, surface water drainage, hydrogeologic framework, and groundwater flow and quality, and discuss how these factors may influence the migration of contaminants.

3.11.1 LOCAL LITHOLOGY

Soils underlying GANGB are made up of several different soil groups. The Ocilla, Ogeechee, and Chipley complexes make up the majority of the surficial soils.

The Ocilla complex soils are fine grained soils with moderate permeability. These soils are typically found in relatively flat areas around the base. Site No. 2, Site No. 5, and Site No. 8 are reportedly underlain by Ocilla complex and Ocilla-Urban complex soils (SCS, 1974). Ocilla complex soils are further characterized by containing a near surface water table. Typically, the groundwater surface will be located within two feet of land surface. The soils reportedly retain excess water and, as a result, do not promote certain types of vegetation.

The Ogeechee series soils are fine grained soils with low permeability. This group may be described as clayey sands and reportedly underlies large portions of GANGB. Ogeechee soils are typically found in low-lying areas and in drainage ways. Ogeechee soils have been documented around Site No. 9 and Site No. 11, and these soils are also reported in isolated locations throughout GANGB (SCS, 1974).

Chipley fine sands are perhaps the most common soil group at GANGB. Chipley soils are fine to medium fine grained soils that posses high permeability and are well drained. Chipley soils are located in most of the topographically high regions across the base and have been documented underlying Site No. 1 and Site No. 10 (SCS, 1974). Chipley fine sands were typically reported as poorly graded fine sands during SI soil borings and were also identified at Site No. 9 and Site No. 11.

Although the Ocilla, Ogeechee, and Chipley soil groups have been the groups most frequently documented at the base, these soils have been modified in some locations. Extensive construction, excavation, and filling has rendered these soils unidentifiable or at least well modified. In most locations, each of these soil groups has been

modified with Urban Land complex (fill material) of unidentifiable classification. Ellabee loamy sand, Wahee Urban Land complex, Pelham loamy sand, Pooler fine sandy loam, and Craven loamy fine sands have also been documented throughout the base (Woolpert, 1990).

The typical lithologic profile observed during an SI soil boring included three soil groups. Surficial sands were located in each of the borings performed. The sands varied in depth from 2 to more than 18 feet bls. The depth of the sands was somewhat dependent upon topographic elevation, the sands but did not follow any identifiable bedding patterns. The surficial sands were poorly graded, fine to very fine, and ranged in color from light gray to black. Varying amounts of silty materials and organics were also identified in discrete locations.

Below the surficial sands, a clayey sand layer was encountered. In most locations, this unit was moderately dense, demonstrated moderately low permeability, and contained the groundwater surface. These soils ranged in color from gold and red to gray and tan. Often, several colors were marbled together producing a somewhat difficult description.

In the northeast quadrant of GANGB, a very dense layer of cemented sands were consistently encountered. These soils were identified at Site No. 10 and Site No. 11 at depths of approximately 12 feet bls. The cemented sands are referred to as hardpan and are the results of ferrous cementation. In most locations, this material exceeded "refusal" during Standard Penetration Test sampling.

Below the clayey-sand or hardpan layers, a second layer of sand was typically encountered. This unit appeared slightly coarser and more permeable than the surficial sands, and ranged in color from tan to gray. In all locations, these soils were saturated.

Although this is a typical soil profile, great variance was encountered across GANGB. Very fat clays were encountered at the discharge point at Site No. 1, organic sands were identified at Site No. 6 and Site No. 8, and silty fine sands were identified at Site No. 9 and Site No. 10.

3.11.2 SURFACE WATER DRAINAGE

GANGB is located within the drainage basin of the Savannah River. Stormwater falling on the base is collected through a series of swales, ditches, and canals and is discharged into a local tributary of the Savannah River called the Pipemakers Canal. The Pipemakers Canal is approximately 12 miles long and flows around the southwest and southeast perimeter of GANGB and discharges into the Savannah River at a point approximately 5 miles northeast of the GANGB. Along its path around the airport, the canal is intersected by a series of drainage ditches, which channel stormwater off the site. These drainage ditches vary in width and depth with season and

precipitation. Some exceeded 8 feet in width and 2 feet in depth during low flow conditions.

The main drainage ditches are networked to GANGB and the Savannah International Airport by a series of smaller ditches and culverts. The principal purpose of these smaller ditches is to channel stormwater off the runways and out of the developed areas. Drainage ditches are in greatest concentration in the southeast and southwest quadrants of GANGB.

Of the nine sites investigated during the SI, five (Site No. 1, Site No. 2, Site No. 7, Site No. 8, and Site No. 9) are influenced by drainage features. In each case, a drainage ditch flows adjacent to a site and possibly receives discharged wastes from a base activity.

3.11.3 HYDROGEOLOGIC FRAMEWORK

The site is in the Coastal Plain physiographic province of eastern Georgia. Within the Coastal Plain is the Southeast Georgia Embayment--a shallow, broad embayment or basin in which sediments accumulated during Miocene through Holocene times. During this period, transgressions and regressions of sea level caused deposition and reworking of sediments in the form of marine terraces. According to a generalized map of marine terraces within Georgia by Huddleston (1988), surficial sediments at the site are probably related to the Pamlico terrace. The Pamlico terrace complex is characterized by short, emergent barrier islands and well-developed back-barrier tracts formed when sea level was approximately 25 feet above its present level (Huddleston, 1988).

Two main aquifer systems exist beneath the site--the surficial and Floridan aquifer systems. Separating these aquifers is the Hawthorn Group sediments, which act as a confining or semiconfining unit to the underlying Floridan aquifer system.

Undifferentiated surficial sands compose the surficial aquifer system at GANGB. These surficial sands of Miocene to Holocene age are generally fine-to-medium grained, moderate-to-well sorted, and are probably remnants of ancient barrier island systems. This aquifer is typically under unconfined or water-table conditions and is approximately 100 feet thick at the site (Clarke et al., 1990). The water table is the upper boundary of this aquifer and is typically encountered at a very shallow depth--approximately 2 to 10 feet below land surface. Because of its unconfined nature, the surficial aquifer is susceptible to surface contamination. Local, thin clay beds with variable continuity and extent are also present and may act as semi-confining units within the aquifer.

A minor aquifer, the upper Brunswick, may also exist just within the surficial aquifer based on geologic and geophysical logs of Well 37Q185 (Clarke et al., 1990), located at nearby Hutchinson Island. According to the logs, this aquifer is approximately

25 feet thick, of limited areal extent, and separated from the surficial sands by approximately 25 feet of low-permeability material.

Underlying the surficial aquifer system is the Hawthorn Group. The Hawthorn Group is locally comprised of two lithologic formations, the Coosawatchie and Marks Head Formations (Huddleston, 1988). The Coosawatchie Formation consists of predominantly phosphatic, sandy clay and fine-grained, well-sorted sands. The Coosawatchie Formation averages 100 feet in thickness at the site (Huddleston, 1988) and disconformably overlies the Marks Head Formation. The Marks Head Formation consists of phosphatic, argillaceous sand and sandy clay (Huddleston, 1988). Together these low-permeability sediments act as a confining unit between the surficial and Floridan aquifers and impede downward migration of potential contaminants.

Underlying the Hawthorn Group sediments is the Floridan aquifer system. Limestones, dolomites, and sands of Oligocene to Middle Eocene age compose the Floridan aquifer (Clarke et al., 1990). This is the principal aquifer system in the area and almost all industrial and municipal water users in the area rely on it as a source of water. Potentiometric surface maps (Clarke et al., 1990) indicate a downward hydraulic gradient locally exists between the surficial and Floridan aquifer systems. This condition has been developed because of the extensive pumpage of the Floridan aquifer by the cities of Savannah and Hilton Head. Because of the lowering of the total head, the Floridan aquifer is no longer artesian in this region. The net result is that a gradient exists from the surficial aquifer to the Floridan aquifer. However, before water (or contamination) can pass between the aquifers, it must first migrate through approximately 120 feet of confining clays (the Hawthorn formation).

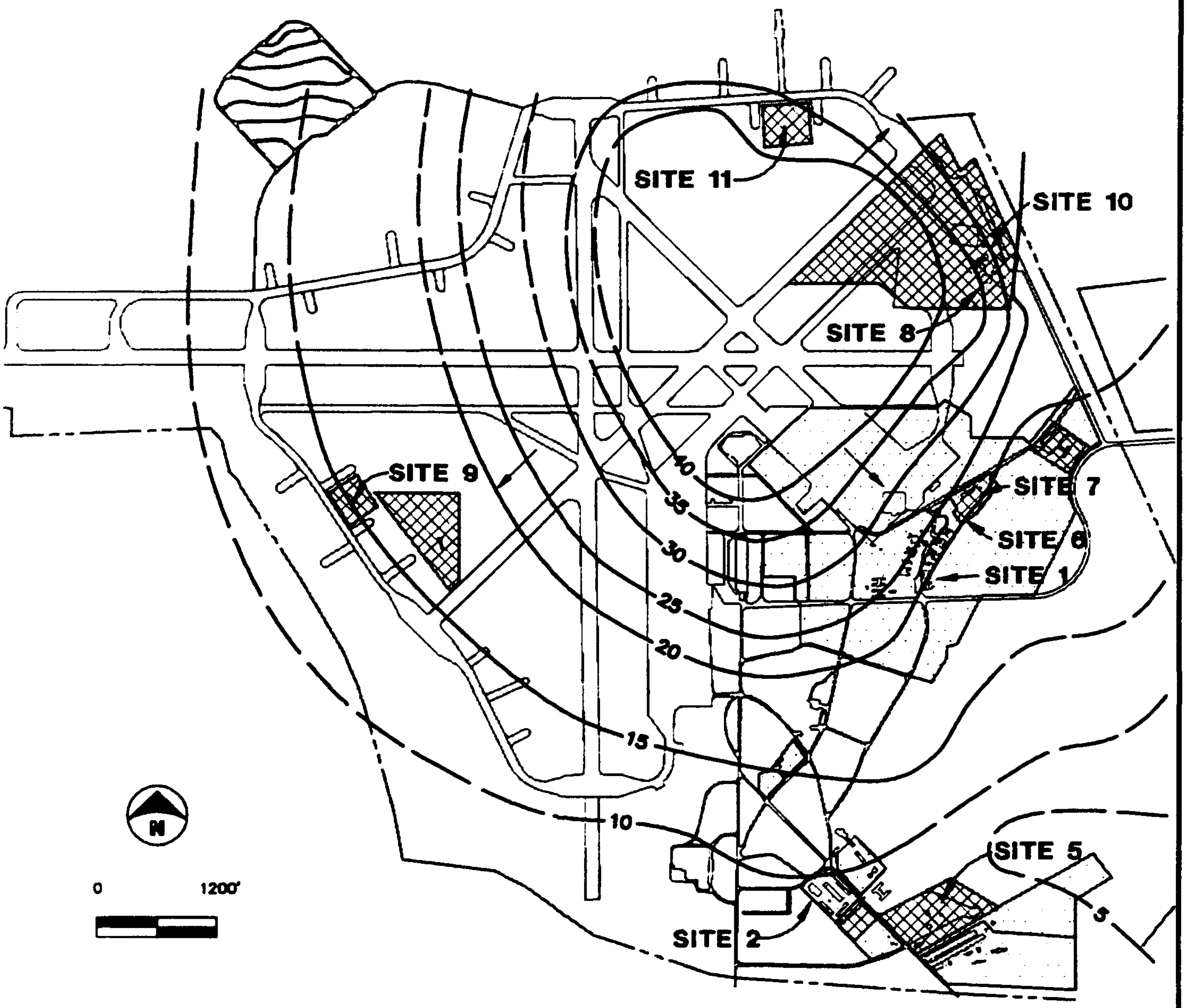
3.11.4 GROUNDWATER FLOW

Figure 3-19 shows the generalized water-table contours across GANGB. These contours are based on depth-to-water measurements of piezometers and wells and staff gauge readings at the site obtained on October 3, 1990; the measurements are shown in Table 3-18. The water-table contours show a groundwater mound at the main intersection of runways at Savannah International Airport. This mound corresponds to a topographic high at GANGB, and therefore it appears that groundwater elevations may mimic topographic features. From this water-table mound, it can be inferred that groundwater flows radially away in all directions from the mound towards areas with lower groundwater elevations. The regional groundwater flow direction in the surficial aquifer system, however, is reported to be east-southeast towards the coast.

3.11.5 GROUNDWATER QUALITY

Water quality in the surficial aquifer system is generally low in total dissolved solids (TDS), ranges in hardness from soft to hard, and is generally suitable for irrigation

01-20-92



LEGEND

165th TACTICAL AIR GROUP PROPERTY BOUNDARIES

COMBAT TRAINING READINESS CENTER (CTRC) PROPERTY BOUNDARIES

WATER TABLE CONTOURS (CONTOUR INTERVAL = 5 FEET ALL WATER LEVELS REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD)

DIRECTION OF GROUNDWATER FLOW

FIGURE 3-19

REGIONALLY PROJECTED GROUNDWATER ELEVATIONS (OCTOBER 3, 1990) GEORGIA AIR NATIONAL GUARD BASE SAVANNAH, GEORGIA

D:\SEF27794.CO\04SITE3.DWG

TABLE 3-18
WATER LEVEL DATA
GEORGIA AIR NATIONAL GUARD
SAVANNAH, GEORGIA
OCTOBER 3, 1990

DATA POINT	DESCRIPTION	TOTAL DEPTH MEASURED (Ft BLS)	SCREENED INTERVAL (Ft BLS)	TOC ELEVATION (Ft NGVD)	DEPTH TO WATER (Ft)	GROUNDWATER ELEVATION (Ft NGVD)	TIME
01-PZ-01	SITE 1 - PIEZOMETER 1	11.25	7.5 - 12.5	31.27	4.15	27.12	11:12 A.M.
01-PZ-02	SITE 1 - PIEZOMETER 2	15.90	8.0 - 18.0	41.38	12.48	28.90	11:15 A.M.
01-PZ-03	SITE 1 - PIEZOMETER 3	14.40	10.0 - 15.0	34.39	5.21	29.18	11:18 A.M.
01-PZ-04	SITE 1 - PIEZOMETER 4	12.14	8.0 - 13.0	21.28	3.17	18.11	11:03 A.M.
01-SW-01	SITE 1 - SURFACE WATER 1	N.A.	N.A.	N.A.	N.A.	14.24	11:01 A.M.
01-MW-01	SITE 1 - MONITOR WELL 1	15.00	3.0 - 13.0	32.01	4.66	27.35	11:09 A.M.
01-MW-02	SITE 1 - MONITOR WELL 2	20.00	5.0 - 15.0	23.54	6.54	17.00	11:00 A.M.
02-SW-01	SITE 2 - SURFACE WATER 1	N.A.	N.A.	13.30	9.58	3.72	11:24 A.M.
02-MW-01	SITE 2 - MONITOR WELL 1	15.00	3.0 - 13.0	16.93	6.57	10.36	11:27 A.M.
05-PZ-01	SITE 5 - PIEZOMETER 1	14.84	10.0 - 15.0	12.60	5.32	7.28	11:32 A.M.
05-PZ-02	SITE 5 - PIEZOMETER 2	14.75	10.0 - 15.0	13.97	8.47	5.50	11:36 A.M.
05-EW-01	SITE 5 - EXISTING WELL 1	14.80	U.K.	15.31	8.73	6.58	11:55 A.M.
05-EW-02	SITE 5 - EXISTING WELL 2	14.67	U.K.	15.74	9.46	6.28	11:57 A.M.
05-MW-01	SITE 5 - MONITOR WELL 1	15.50	5.0 - 15.0	13.95	8.04	5.91	11:38 A.M.
05-MW-02	SITE 5 - MONITOR WELL 2	14.00	3.0 - 13.0	11.80	5.95	5.85	11:48 A.M.
05-MW-03	SITE 5 - MONITOR WELL 3	15.00	3.0 - 13.0	12.43	6.85	5.58	11:51 A.M.
05-MW-04	SITE 5 - MONITOR WELL 4	16.00	5.0 - 15.0	14.97	8.01	6.96	11:42 A.M.
06-PZ-01	SITE 6 - PIEZOMETER 1	10.42	5.5 - 10.5	25.18	5.06	20.12	10:53 A.M.
06-PZ-02	SITE 6 - PIEZOMETER 2	13.85	9.5 - 14.5	27.54	3.58	23.96	10:49 A.M.
06-MW-01	SITE 6 - MONITOR WELL 1	5.00	1.5 - 4.5	25.80	6.81	18.99	10:56 A.M.
07-PZ-01	SITE 7 - PIEZOMETER 1	11.12	7.0 - 12.0	23.64	3.98	19.66	10:36 A.M.
07-SW-01	SITE 7 - SURFACE WATER 1	N.A.	N.A.	24.74	4.55	20.19	10:38 A.M.
07-EW-01	SITE 7 - EXISTING WELL 1	11.20	U.K.	27.48	5.68	21.80	10:43 A.M.
07-EW-02	SITE 7 - EXISTING WELL 2	11.07	U.K.	27.87	6.38	21.49	10:45 A.M.
07-EW-03	SITE 7 - EXISTING WELL 3	10.82	U.K.	28.12	U.K.	U.K.	N.A.
07-MW-01	SITE 7 - MONITOR WELL 1	15.00	2.5 - 12.5	23.39	3.52	19.87	10:43 A.M.

NOTES:

U.K. = UNKNOWN
N.A. = NOT APPLICABLE
BLS = BELOW LAND SURFACE
TOC = TOP OF CASING
ALL MEASUREMENTS IN FEET
ELEVATIONS REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD)

TABLE 3-18 (Cont.)
WATER LEVEL DATA
GEORGIA AIR NATIONAL GUARD
SAVANNAH, GEORGIA
OCTOBER 3, 1990

DATA POINT	DESCRIPTION	TOTAL DEPTH MEASURED (Ft BLS)	SCREENED INTERVAL (Ft BLS)	TOC ELEVATION (Ft NGVD)	DEPTH TO WATER (Ft)	GROUNDWATER ELEVATION (Ft NGVD)	TIME
08-SW-01	SITE 8 - SURFACE WATER 1	N.A.	N.A.	32.44	6.92	25.52	10:30 A.M.
08-MW-01	SITE 8 - MONITOR WELL 1	15.00	3.0 - 13.0	32.99	9.99	23.00	10:25 A.M.
08-MW-02	SITE 8 - MONITOR WELL 2	18.00	7.0 - 17.0	42.57	9.32	33.25	10:14 A.M.
08-MW-03	SITE 8 - MONITOR WELL 3	15.00	3.0 - 13.0	33.33	6.30	27.03	10:17 A.M.
08-MW-04	SITE 8 - MONITOR WELL 4	15.00	3.5 - 13.5	30.91	8.13	22.78	10:20 A.M.
09-PZ-01	SITE 9 - PIEZOMETER 1	12.35	8.5 - 13.5	20.94	4.06	16.88	8:29 A.M.
09-PZ-02	SITE 9 - PIEZOMETER 2	14.75	10.0 - 15.0	21.25	7.73	13.52	8:10 A.M.
09-PZ-03	SITE 9 - PIEZOMETER 3	14.85	10.0 - 15.0	21.18	5.95	15.23	8:17 A.M.
09-SW-01	SITE 9 - SURFACE WATER 1	N.A.	N.A.	20.43	3.30	17.13	8:37 A.M.
09-SW-02	SITE 9 - SURFACE WATER 2	N.A.	N.A.	18.43	5.69	12.74	8:15 A.M.
09-MW-01	SITE 9 - MONITOR WELL 1	15.00	3.0 - 13.0	20.86	6.68	14.18	8:19 A.M.
09-MW-02	SITE 9 - MONITOR WELL 2	15.00	3.0 - 13.0	20.42	6.22	14.20	8:22 A.M.
09-MW-03	SITE 9 - MONITOR WELL 3	15.00	4.0 - 14.0	20.99	7.74	13.25	8:13 A.M.
09-MW-04	SITE 9 - MONITOR WELL 4	15.00	4.5 - 14.5	21.20	7.07	14.13	8:25 A.M.
09-MW-05	SITE 9 - MONITOR WELL 5	15.00	3.0 - 13.0	21.83	3.56	18.27	8:33 A.M.
10-PZ-01	SITE 10 - PIEZOMETER 1	16.70	13.0 - 18.0	44.96	10.81	34.15	10:11 A.M.
10-PZ-02	SITE 10 - PIEZOMETER 2	17.55	13.0 - 18.0	43.69	11.81	31.88	10:04 A.M.
10-PZ-03	SITE 10 - PIEZOMETER 3	18.91	14.0 - 19.0	44.42	9.00	35.42	10:08 A.M.
10-MW-01	SITE 10 - MONITOR WELL 1	19.00	8.0 - 18.0	44.68	12.40	32.28	10:00 A.M.
11-EW-B3	SITE 11 - EXISTING WELL B	U.K.	U.K.	47.39	7.30	40.09	9:24 A.M.
11-EW-C1	SITE 11 - EXISTING WELL C	9.50	U.K.	48.03	10.46	37.57	9:30 A.M.
11-EW-C2	SITE 11 - EXISTING WELL C	U.K.	U.K.	46.12	8.41	37.71	9:27 A.M.
11-EW-D2	SITE 11 - EXISTING WELL D	U.K.	U.K.	43.59	9.32	34.27	9:33 A.M.
11-MW-01	SITE 11 - MONITOR WELL 1	19.00	7.0 - 17.0	45.30	9.31	35.99	9:46 A.M.
11-MW-02	SITE 11 - MONITOR WELL 2	19.00	8.0 - 18.0	45.52	10.94	34.58	9:42 A.M.
11-MW-03	SITE 11 - MONITOR WELL 3	18.00	7.0 - 17.0	45.09	10.52	34.57	9:37 A.M.

NOTES:

U.K. = UNKNOWN
N.A. = NOT APPLICABLE
BLS = BELOW LAND SURFACE
TOC = TOP OF CASING
ALL MEASUREMENTS IN FEET
ELEVATIONS REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD)

purposes. Clarke et al. (1990) report a median chloride concentration of 28 mg/L in coastal Georgia, but this value is highly dependent on proximity to the shoreline where saltwater intrusion is possible.

Each of the predominant soil groups was reportedly acidic (Woolpert, 1990), and as a result, groundwater demonstrated acidic properties. Groundwater samples collected from each of the monitor wells was tested for pH and conductivity. Across the base, pH was observed to vary between 4.1 and 5.6. Although groundwater was acidic, groundwater quality at Site No. 1 and Site No. 8 demonstrated the lowest pH (averages of 4.8 and 4.35 respectively). Both sites are underlain by Chipley complex soils, which may be the reason for the observed pH values.

Conductivity values appeared moderately low throughout the base and demonstrated low dissolved mineral contents. Conductivity values ranged from 35 to 350 µmhos/cm. Average values were approximately 60 µmhos/cm. No trend or pattern can be derived from conductivity values other than they all appeared moderately low. Clark et al. (1990) reported a median value for chloride concentration of approximately 28 mg/l in coastal Georgia. This value is highly dependant upon the effects of salt-water intrusion and the proximity of the sampling location to the coast. Based upon the conductivity values observed, it appears that chloride concentrations are probably lower than 28 mg/l and that the site may not be experiencing the effects of coastal salt water intrusion.

During the development of the 22 wells installed during the SI, groundwater quality of the surficial aquifer was observed. Although the wells were constructed into the surficial sediments, groundwater appeared excessively turbid and high in color. Because of these properties and the general low values of hydraulic conductivity of the surficial aquifer, this aquifer has not been tapped as a productive potable water source. Additionally, because of the lack of a true confining unit, the surficial aquifer is subject to local contamination from surface activities, spills, or discharges.

3.12 QUALITY CONTROL SAMPLES

Additional samples were collected during the SI as described in the SI SAP Quality Assurance Project Plan. Four types of quality control samples were collected to verify that decontamination, sampling, shipping, and laboratory techniques met the program quality objectives. Quality control samples consisted of field duplicates, trip blanks, equipment rinsate blanks, and field blanks. The results of the quality control sampling performed during the SI field activities are summarized in Tables 3-19, 3-20, 3-21, and 3-22. The tables show only those compounds detected above method detection limits.

Field duplicates are collected at approximately a 10 percent frequency. The samples are duplicates of normal samples and are collected without identifying to the lab-

TABLE 3-19
SUMMARY OF VOC ANALYSES
FOR SAMPLES HAVING ASSOCIATED DUPLICATES
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Vinyl Chloride	[illegible]chloro-methane	1,1-DCA	1,1,1-TCA	TCE	1,3-DCB	1,2-DCB	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes
06-HA-08	1.2 U	2.4 UJ	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 UJ
06-HA-BD	1.2 U	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 UJ
05-SB-03 (1-3'bls)	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
05-SB-D1	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
08-SB-02 (2-4'bls)	1.0 UJ	1.0 U	1.0 U	1.2	2.2	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
08-SB-D4	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 UJ	1.1 U	1.1 U	1.1 U	1.1 U
09-SB-03 (6-8'bls)	1.1 UJ	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
09-SB-D2	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
11-SB-02 (10-12'bls)	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
11-SB-D3	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 UJ	1.3 U	1.3 U	1.3 U	1.3 U
08-MW-01	1000 U	1000 U	1000 U	1000 U	69000	1000 U	1000 U	1000 UJ	1000 U	1000 U	1000 U	1000 U
08-MW-D1	1000 U	3600 J	1000 U	1000 U	79000	1000 U	1000 U	1000 UJ	1000 U	1000 U	1000 U	1000 U
09-MW-02	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.3 J	220 *J	470 *J	67	500 *
09-MW-D3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.1 J	200 *J	440 *J	62	480 *
11-MW-01	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	36 J	39 J	1.0 U	170 *
11-MW-D2	1.0 UJ	2.6 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	36 J	88 J	41 J	290 *J
07-SW-02	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
07-SW-D2	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
09-SW-02	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
09-SW-D1	1.0 UJ	2.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
01-SS-11	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 UJ	1.4 U	1.4 U	1.4 U	1.4 U
01-SS-D3	1.4 U	5.3	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U	1.4 UJ	1.4 U	1.4 U	1.4 U	1.4 U
08-SS-06	10.3 J	7.9 UJ	2.9 J	44.3 J	801 *	7.3	20.3	1.2 UJ	1.2 U	1.6 J	1.2 U	4.7
08-SS-D1	1.2 U	19.1 UJ	1.2 U	1.2 U	2.4	1.2 U	1.3	1.2 UJ	1.2 U	1.2 U	1.2 U	1.2 U
09-SS-01	1.2 U	5.0	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
09-SS-D2	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ	1.1 J	1.3 UJ

NOTES:

bls = Below Land Surface
HA = Hand Auger
MW = Monitor Well
SB = Soil Boring
SS = Sediment Sample
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
* = Sample result for this compound exceeded calibration range of instrument

1,1-DCA = 1,1-Dichloroethane
1,1,1-TCA = 1,1,1-Trichloroethane
TCE = Trichloroethene
1,3-DCB = 1,3-Dichlorobenzene
1,2-DCB = 1,2-Dichlorobenzene
MTBE = tert-Butyl Methyl Ether

TABLE 3-20
SUMMARY OF PAH AND TPH ANALYSES
FOR SAMPLES HAVING ASSOCIATED DUPLICATES
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Naphthalene	2-Methyl-Naphthelene	1-Methyl-Naphthelene	Phenanthrene	Anthracene	Flouoranthene	Pyrene
06-HA-08	75 U	75 U	75 U	75 U	75 U	75 U	75 U
06-HA-BD	62 U	62 U	62 U	62 U	62 U	62 U	62 U
05-SB-03 (1-3'bls)	52 U	52 U	52 U	52 U	52 U	52 U	52 U
05-SB-D1	52 U	52 U	52 U	52 U	52 U	52 U	52 U
08-SB-02 (0-2'bls)	110 U	110 U	110 U	110 U	110 U	110 U	110 U
08-SB-D4	110 U	110 U	110 U	110 U	110 U	110 U	110 U
09-SB-03 (4-6'bls)	59 U	59 U	59 U	59 U	59 U	59 U	59 U
09-SB-D2	58 U	58 U	58 U	58 U	58 U	58 U	58 U
11-SB-02 (10-12'bls)	63 U	63 U	63 U	63 U	63 U	63 U	63 U
11-SB-D3	63 U	63 U	63 U	63 U	63 U	63 U	63 U
08-MW-01	2	2 U	2 U	2 U	2 U	2 U	2 U
08-MW-D1	5	2 U	2 U	2 U	2 U	2 U	2 U
09-MW-02	50 U	130	118	20 U	20 U	20 U	20 U
09-MW-D3	10 U	77	95	10 U	10 U	10 U	10 U
11-MW-01	3	3	5	2 U	2 U	2 U	2 U
11-MW-D2	2 U	2	4	2 U	2 U	2 U	2 U
07-SW-02	2 U	2 U	2 U	2 U	2 U	2 U	2 U
07-SW-D2	2 U	2 U	2 U	2 U	2 U	2 U	2 U
09-SW-02	2 U	2 U	2 U	2 U	2 U	2 U	2 U
09-SW-D1	2 U	2 U	2 U	2 U	2 U	2 U	2 U
01-SS-11	62 U	62 U	62 U	62 U	62 U	62 U	62 U
01-SS-D3	67 U	67 U	67 U	67 U	67 U	67 U	67 U
08-SS-06	600 U	600 U	600 U	3200 J	780 J	2900 J	2800 J
08-SS-D1	300 U	300 U	300 U	550	300 U	1200	1300
09-SS-01	580 U	580 U	580 U	580 U	580 U	580 U	580 U
09-SS-D2	600 U	600 U	600 U	600 U	600 U	600 U	600 U

NOTES:

bls = Below Land Surface
HA = Hand Auger
MW = Monitor Well
SB = Soil Boring
SS = Sediment Sample
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit

TABLE 3-20 (CONT'D)
SUMMARY OF PAH AND TPH ANALYSES
FOR SAMPLES HAVING ASSOCIATED DUPLICATES
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Benzo (a)-anthracene	Chrysene	Benzo (b)-fluoranthene	Benzo(k)-fluoranthene	Benzo(a)-pyrene	Indeno(1,2,3-cd)-pyrene	Dibenzo(a,h)-anthracene	Benzo(q,h,i,)-perylene	TPH
06-HA-08	75 U	75 U	75 U	75 U	75 U	75 U	75 U	75 U	<2.2
06-HA-BD	62 U	62 U	62 U	62 U	62 U	62 U	62 U	62 U	<2.1
05-SB-03 (1-3'bls)	52 U	52 U	52 U	52 U	52 U	52 U	52 U	52 U	15.8
05-SB-D1	52 U	52 U	52 U	52 U	52 U	52 U	52 U	52 U	33.8
08-SB-02 (0-2'bls)	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	13.0
08-SB-D4	110 U	110 U	110 U	110 U	110 U	110 U	110 U	110 U	8.0
09-SB-03 (4-6'bls)	59 U	59 U	59 U	59 U	59 U	59 U	59 U	59 U	<1.9
09-SB-D2	58 U	58 U	58 U	58 U	58 U	58 U	58 U	58 U	<1.9
11-SB-02 (10-12'bls)	63 U	63 U	63 U	63 U	63 U	63 U	63 U	63 U	<2.0
11-SB-D3	63 U	63 U	63 U	63 U	63 U	63 U	63 U	63 U	<2.1
08-MW-01	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	14.8
08-MW-D1	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	18.5
09-MW-02	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	3.70
09-MW-D3	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4.28
11-MW-01	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.12
11-MW-D2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.12
07-SW-02	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	<0.06
07-SW-D2	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	<0.06
09-SW-02	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.38
09-SW-D1	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.45
01-SS-11	62 U	62 U	62 U	62 U	62 U	62 U	62 U	62 U	<2.1
01-SS-D3	67 U	67 U	67 U	67 U	67 U	67 U	67 U	67 U	<2.2
08-SS-06	1100 J	1600 J	730 J	480 J	930 J	860 J	600 U	600 U	13.3
08-SS-D1	770	900	600	400	850	840	280 J	620	33.1
09-SS-01	580 U	580 U	580 U	580 U	580 U	580 U	580 U	580 U	67.9
09-SS-D2	600 U	600 U	600 U	600 U	600 U	600 U	600 U	600 U	67.8

NOTES:

bls = Below Land Surface
HA = Hand Auger
MW = Monitor Well
SB = Soil Boring
SS = Sediment Sample
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit

TABLE 3-21
SUMMARY OF PRIORITY POLLUTANT METAL ANALYSES
FOR SAMPLES HAVING ASSOCIATED DUPLICATES
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

Sample	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead (F)	Lead (UF)	Mercury	Nickel	Silver	Selenium	Zinc
06-HA-08	0.21	<0.0053	0.23	1.6	2.2	NS	2.3	0.10	1.0	<0.89	0.21	5.5
06-HA-BD	0.16	<0.0051	<0.20	1.2	1.7	NS	1.8	0.10	1.0	<0.85	0.14	2.9
05-SB-03 (1-3'bls)	2.1	<0.52	<0.52	4.7	<1.0	NS	9.3	<0.02	<2.6	<1.0	<1.3 J	5.2
05-SB-D1	5.5	<0.52	<0.52	5.2	<1.0	NS	25.5	<0.02	<2.6	<1.0	<1.3 J	9.9
08-SB-02 (0-2'bls)	<0.53 J	<0.53	<0.53	7.4	<1.1	NS	19.0	<0.02	2.6	<1.0	<1.3 J	1.6
08-SB-D4	<0.53	<0.53	<0.53	3.7	<1.1	NS	2.6	<0.02	<2.6	<1.0	<1.3	1.1
09-SB-03 (4-6'bls)	1.9	<0.59	<0.59	12.4	<1.2	NS	5.3	<0.02	4.1	<1.2	<1.5 J	4.1
09-SB-D2	0.81	<0.58	<0.58	13.4	<1.2	NS	8.7	<0.02	4.7	<1.2	<1.4	4.7
11-SB-02 (10-12'bls)	<0.62	<0.62	<0.62	9.4	<1.2	NS	6.2	<0.02	6.2	<1.2	<1.5	0.62
11-SB-D3	<0.63	<0.63	<0.63	7.0	<1.3	NS	5.7	<0.02	3.8	<1.3	<1.6	1.3
08-MW-01	<0.005	<0.005	0.0007	0.065	0.02	<0.002	0.108	0.0005	<0.04	<0.01	<0.025 R	0.03
08-MW-D1	<0.005	0.007	0.0006	0.069	0.02	<0.002	0.082	0.0004	<0.04	<0.01	<0.025 R	0.02
09-MW-02	0.008 J	0.010	0.0013	0.110	0.04	<0.002	0.018	0.0003	<0.04	0.015	<0.025 R	0.19
09-MW-D3	0.007 J	0.010	0.0011	0.111	0.11	<0.002	0.022	0.0002	0.05	0.014	<0.025 R	0.10
11-MW-01	<0.010	<0.005	0.0004	0.099	0.06	0.003 J	0.112 J	<0.0002	<0.04	0.013 J	<0.025	0.08 J
11-MW-D2	<0.010	<0.005	0.0004	0.101	0.05	<0.002	0.117 J	<0.0002	<0.04	<0.010 J	<0.025	0.07 J
09-SW-02	0.007	<0.005	<0.0002	<0.002	<0.02	<0.002	0.003	<0.0002	<0.04	<0.01	<0.005 J	<0.01
09-SW-D1	0.007	<0.005	<0.0002	<0.002	<0.02	0.002	0.004	<0.0002	<0.04	<0.01	<0.005 J	<0.01
01-SS-11	1.3 J	0.64	<0.03	2.2	<2.6	NS	24.1	<0.03	<4.9	<1.2	<3.0 J	57.3
01-SS-D3	0.78	<0.65	<0.03	10.9	<2.6	NS	4.4	<0.03	<5.2	<1.3	<3.2 J	5.2
08-SS-06	0.84 J	<0.60	0.12	26.0	2.4	NS	17.1	0.07	<4.8	<1.2	<0.60 J	6.0
08-SS-D1	0.72 J	<0.60	0.20	22.0	3.6	NS	23.5	0.02	<4.8	<1.2	<0.60 J	7.2
09-SS-01	1.2	<0.62	<0.02	4.7	<2.5	NS	24.0	<0.024	<4.9	<1.2	<0.62	5.6
09-SS-D2	0.99 J	<0.62	<0.02	10.5	<2.5	NS	7.9	<0.025	<5.0	<1.2	<0.62	6.2

NOTES:
bls = Below Land Surface
F = Filtered sample
HA = Hand Auger
MW = Monitor Well
NS = Not Sampled
SB = Soil Boring
SS = Sediment Sample
SW = Surface Water
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
UF = Unfiltered sample
R = Quality control indicates data not usable.

TABLE 3-22

SUMMARY OF PRIORITY POLLUTANT METALS, VOC, PAH AND TPH ANALYSES
FOR TRAVEL, RINSATE, AND FIELD BLANKS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	Sample	Date Sampled	Beryllium	Chromium	Copper	Lead (UF)	Mercury	Zinc	Dichloro-methane	Trichloro-fluoromethane	TPH
II.	Travel Blanks										
	Travel Blank #1	05-22-90	NS	NS	NS	NS	NS	NS	1.0 U	1.0 UJ	NS
	Travel Blank #2	05-25-90	NS	NS	NS	NS	NS	NS	3.0		NS
	Travel Blank #3	06-27-90	NS	NS	NS	NS	NS	NS	1.5 J	5.5 J	NS
	Travel Blank #4	06-29-90	NS	NS	NS	NS	NS	NS	1.7	1.0 U	NS
	Travel Blank #5	09-14-90	NS	NS	NS	NS	NS	NS	3.1 UJ	1.0 U	NS
	Travel Blank #6	09-15-90	NS	NS	NS	NS	NS	NS	3.3 J	1.0 U	NS
	Travel Blank #7	09-18-90	NS	NS	NS	NS	NS	NS	3.7 J	1.0 U	NS
	Travel Blank #8	09-20-90	NS	NS	NS	NS	NS	NS	2.9 J	1.0 U	NS
	Travel Blank #9	09-21-90	NS	NS	NS	NS	NS	NS	2.3 J	1.0 U	NS
	Travel Blank #10	09-24-90	NS	NS	NS	NS	NS	NS	1.0 U	1.0 U	NS
	Travel Blank #11	09-25-90	NS	NS	NS	NS	NS	NS	1.0 U	1.0 U	NS
	Travel Blank #12	09-26-90	NS	NS	NS	NS	NS	NS	1.0 U	1.0 U	NS
III.	Rinsate Blanks										
	Rinsate Blank	05-25-90	<0.040	<5.5	7.1	<0.92	0.20	33.9	17 UJ	1.0	0.18
	Rinsate Blank	06-29-90	<0.01	<0.05	<0.02	<0.05	<0.0002	<0.01	2.0 UJ	1.0 U	<0.06
	Rinsate Blank #1	09-14-90	<0.005	<0.002	<0.02	<0.002	<0.0002	<0.01	150 J	1.0 U	<0.06
	Rinsate Blank #3	09-17-90	<0.005	<0.002	<0.02	<0.002	<0.0002	<0.01	2.8 UJ	1.0 U	0.08
	Rinsate Blank #5	09-19-90	NS	NS	NS	NS	NS	NS	4.3 UJ	1.0 U	<0.06
	Rinsate Blank #7	09-21-90	<0.005	0.003	<0.02	0.003	<0.0002	<0.01	1.0 U	1.0 U	<0.05
	Rinsate Blank #9	09-25-90	<0.005	<0.002	<0.02	<0.002	<0.0002	<0.01	18	1.0 U	<0.05
IV.	Field Blanks										
	Field Blank #1	05-25-90	0.00014	<0.0055	0.0202	0.004	0.0002	0.044	3.0 UJ	1.0 U	0.21
	Field Blank #2	09-20-90	<0.005	<0.002	<0.02	0.003	<0.0002	0.03	1.0 U	1.0 U	<0.06

NOTES:
NS = Not Sampled
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit
UF = Unfiltered Sample
TPH = Total Petroleum Hydrocarbon
Concentrations expressed as milligrams per liter (mg/l) for metals and TPH and micrograms per liter (ug/l) for volatile organics

oratory location number (blind duplicates) to monitor the quality of samples and laboratory methods.

Trip blanks are defined as samples that originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the shipment of samples. One trip blank is included and analyzed with each shipment (cooler) of samples to be analyzed for VOCs. Trip blanks do not apply for PAH compounds, TPH, or priority pollutant metal samples.

Equipment rinsate samples are the final analyte-free water rinse from equipment decontamination. Equipment blanks are collected daily; however, only samples from every other day are analyzed. Alternate day samples are held and analyzed only if there is evidence of contamination in the rinsate sampling. Table 3-22 presents the results of the analyses performed on rinsate samples. Rinsate samples were collected from sampling equipment including stainless steel hand augers, split-spoon liners, and well bailers. The data indicates that trace quantities of some metals, dichloromethane, and TPH compounds were detected in some of the rinsate samples. In the case of the metals analyses, trace quantities of copper, mercury, and zinc were detected in one sample collected on 5-25-90. Although these compounds were detected, their respective concentrations are below action levels and substantially below the concentrations observed in the samples collected (hand-auger borings from Site Number 5) using the equipment. Results from other samples indicate observed concentrations only slightly above method detection limits.

The detection of dichloromethane in two of the samples is probably due to laboratory cross-contamination. This compound has been detected in most analytical samples at concentrations acceptable to laboratory quality control standards as described in EPA functional guidelines for laboratory operations. TPH compounds were also detected in two rinsate samples at very low concentrations. On the sample collected on 5-25-91, it should be noted that the rinsate sample is slightly lower than the source of water used to perform decontamination (See Field Blank #1 collected 5-25-90). Based on this data, it appears that the source of rinsate water may actually contain some very minor and undistinguishable organic contamination.

Even though some compounds were positively identified in the rinsate samples, their respective concentrations were substantially below action levels and the concentrations detected in actual analytical samples. Based on these results, it appears that the decontamination procedures employed were successful in removing contaminants and preventing cross-over contamination.

Field blanks are samples of water used in decontamination and steam cleaning of field and sampling equipment. One field blank was collected from each source of decontamination water used during each separate sampling event and analyzed for VOCs, PAH compounds, TPH, and priority pollutant metals. Only one source of decon-water was used during both field investigations. However, because the field

activities were broken into two separate phases, two field blanks were collected and analyzed.

The results of the analyses of the field blanks indicates that trace quantities of metals (beryllium, copper, lead, mercury and zinc) are present in the water source. Although these compounds were detected, their respective concentrations do not appear to have interfered with analytical sample results.

Additionally, TPH compounds were detected in the Field Blank sample which was collected on 5-25-90. The source of this contamination is unknown and may have interfered slightly with the analytical results produced from soil samples. Because soil sampling equipment is not immersed in the material before it collects the sample, some interference may be present from artifacts of the decontamination procedure. Assuming the worst case, soil samples collected from the Hand Auger borings at Site Number 5 and 6 may have observed TPH concentrations up to 0.21 mg/l (mg/kg) higher than actually present in the soil.

Tables 3-19, 3-20, and 3-21 lists the analytical results for stations having duplicate samples, and shows the results for the original sample and its associated duplicate sample. In general, the analytical results for duplicate samples yielded similar results.

Table 3-22 lists the analytical results for contaminant detections in travel, rinsate, and field blank samples. Dichloromethane was detected in travel blanks and rinsate blanks. Dichloromethane is a common laboratory artifact since it is used extensively during extraction of samples. The detection of this compound as an artifact of laboratory operations is described and acknowledged in EPA's functional guidelines. Trichlorofluoromethane was detected in one travel blank at an estimated concentration of 5.5 μg/l. Copper, lead, mercury and zinc was detected above the detection limits in one rinsate blank. Beryllium, copper, lead, mercury and zinc were detected in one field blank above detection limits. The source of the field blank was a potable water system used for decontamination. In some samples, the reported detection limit has been raised above the method detection limit in instances where interferences of substantial contamination is present. In some cases, these samples have been described with a qualifier. These qualifiers are shown on the data tables.

Section 4
DATA VALIDATION RESULTS

4.1 INTRODUCTION

The data quality objectives for the SI require data validation in accordance with Level C quality control (QC) guidelines promulgated by HAZWRAP. Data validation for this project was performed by the firm of C.C. Johnson & Malhotra, P.C. The validation summaries for the VOC, PAH, priority pollutant metal, and TPH laboratory information are contained in Appendix G. The following summarizes the data validation step of the SI.

Laboratory analytical data generated from samples collected during the SI were prepared as data packages consisting of forms and control charts that conformed to the requirements for Level C deliverables. The forms presented and summarized the raw data and were reviewed against criteria established in validation guidelines.

For this project, data validation was performed according to the guidelines presented by HAZWRAP for Level C when applicable. If analyses were not covered by these guidelines, data were reviewed against either laboratory data validation functional guidelines from EPA or similar procedures outlining sample holding times, initial calibration, continuing calibration, matrix spike, blank spike, and blank versus sample results for the method involved.

The raw data were reviewed to verify sample identity, instrument calibration, detection limits, numerical computations, accuracy of transcriptions, and chemical interpretations. QC samples were processed to demonstrate that the analytical results were within laboratory-prescribed criteria for accuracy and precision. Data were accepted without qualification when QC and quality assurance measures were demonstrated to have been met.

For data that did not strictly meet the criteria, the data validation summary provided tables that identify the affected data by letter flags. The flags also appear on the data summaries that are used in Section 3 of this SI Report.

Data that are found to be unusable were given an "R" qualifier. Such data were rejected because the compound may or may not be present and the data are not considered suitable for use in a preliminary risk evaluation. No samples with positive detections were qualified as unusable. Data could also be flagged if biases could be present or concentrations estimated, such as with low surrogate spike recoveries and/or unacceptable precision criteria. In such circumstances, the reported constituents were known to be present, but there was uncertainty about the concentrations. These data were qualified with a "J". Although these data were used in the

preliminary risk evaluation as positive results, they do create uncertainties in the associated risk estimates.

4.2 VOLATILE ORGANIC COMPOUNDS

VOC analyses were performed on soil, sediment, surface water and groundwater samples. All data deliverables specified for HAZWRAP Level C were included in the data packages submitted to the data validation subcontractor. The results of the data validation were as follows:

- Samples were extracted and analyzed within the holding times specified by the HAZWRAP data validation guidelines.

- Of the compounds detected, the percent relative standard deviation (% RSD) for the initial calibrations and continuing calibrations met the data validation requirements.

- Positive results with a percent difference (% D) for the continuing calibration greater than 15 percent were qualified with a "J" indicting that the compound was detected and/or the reported value was an estimate.

- Method blanks were extracted and analyzed within the specified frequency.

- Dichloromethane was detected in eight trip blanks. Trichlorofluoromethane was detected in one trip blank. Dichloromethane was also detected in seven rinsate or decontamination blanks. Trichlorofluoromethane was detected in one rinstate blank.

- Surrogate recoveries were outside control limits for sediment sample 09-SS-D2 and groundwater sample 11-MW-D2; therefore, these sample results were qualified as estimates (J or UJ).

- Blank samples were performed with each sample batch and were within the laboratory control limits or within the Contract Laboratory Program (CLP) matrix spike and matrix spike duplicate control limits.

- The matrix spike and matrix spike duplicates were performed within recommended QC specification.

4.3 POLYNUCLEAR AROMATIC HYDROCARBON COMPOUNDS

PAH analyses were performed on soil, sediment, surface water, and groundwater samples. All data deliverables specified for HAZWRAP Level C were included in the data packages submitted to the data validation subcontractor. The results of the data validation were as follows:

- Samples were extracted and analyzed within holding times. Two samples (09-SB-02 0-2 and 09-SB-03 4-6), however, were reanalyzed for confirmation. The reanalysis was extracted one day beyond the holding time, but was analyzed within the holding time. The reanalysis samples, therefore, were flagged with a "J".

- The relative standard deviation (%RSD) for the initial calibrations and the percent difference (%D) for the continuing calibration were outside acceptable ranges for acenaphthylene for surface water samples from Site No. 1, Site No. 7, and Site No. 9. These samples were assigned a "J" flag for acenaphthylene. No positive detections for acenaphthylene, however, were observed.

- The frequency and contaminants reported for method blank extractions and analyses were within specified limits.

- PAH compounds were not detected in decontamination blanks and field blanks.

- Matrix spike and matrix spike duplicates were performed within the necessary frequency.

4.4 PRIORITY POLLUTANT METALS

Priority pollutant metal analyses included measurement of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. All data deliverables as specified for HAZWRAP Level C quality control were included in the data packages submitted to the validation subcontractor. The results of the data validation were as follows:

- Samples were prepared and analyzed within holding times.

- Summary forms necessary to determine that initial calibration curves met guidelines or method criteria were submitted.

- The initial calibration verification (ICV) and continuing calibration verification (CCV) standard analyses were reported as required.

Noncompliant ICV or CCV standards for antimony were outside the acceptable values for the sample batch containing sediment samples from Site No. 1. Consequently sample results for antimony in sediment samples from Site No. 1 were rejected and given an "R" qualifier. No positive detections for antimony, however, were observed.

- Blank quality control samples were in compliance with Level C requirements with regard to method preparation, analysis frequency, detection limits, and analysis results.

- Blank spike/laboratory control sample analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within CLP matrix spike control limits.

- Laboratory control charts were provided in the package, and the limits specified by the control charts were used for review.

- The matrix spike frequency requirement was met.

- The matrix spike analyses were outside control limits for compounds and samples listed in Appendix G and qualified on the summary tables in Section 3 where appropriate.

4.5 TOTAL PETROLEUM HYDROCARBON

Total petroleum hydrocarbon analyses were performed on soil, sediment, surface water, and groundwater samples. All data deliverables as specified for HAZWRAP Level C quality control were included in the data packages submitted to the validation subcontractor. The results of the data validation are as follows:

- Samples were prepared and analyzed within holding times.

- Summary forms necessary to determine that initial calibration curves met guidelines or method criteria were submitted, except for a 5-point calibration for two water samples (rinsate and decontamination samples collected on May 25, 1990). HAZWRAP data validation guidelines require results to be qualified with an "R" if a 3- to 5- point calibration is not performed daily. The HAZWRAP specifications for the laboratory and the method itself do not specifically state that a 5-point calibration be performed daily. The reviewer noted that a 5-point calibration was performed 3 days before the analysis of these two samples and the continuing calibration checks were performed.

- The continuing calibration checks were summarized as required, and the review indicated that the system stability was adequate and verified at the required frequency.

- Blank quality control samples were in compliance with Level C requirements with regard to method preparation, analysis frequency, detection limits, and analysis results.

- Blank spike/laboratory control sample analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within method control limits.

- Laboratory control charts were provided in the package, and the limits specified by the control charts were used for review.

- The matrix spike frequency requirement was met.

- The matrix spike and matrix spike duplicate recovery procedures were performed and met all recommended specifications.

Section 5
PRELIMINARY RISK EVALUATION

The purpose of this preliminary risk evaluation is to assess the human and environmental risks associated with the contaminants detected during the SI of the nine GANGB sites.

The goals of the preliminary risk evaluation are identification of the following:

- Imminent threats posed by uncontrolled releases
- Potential toxicological significance of site contaminants
- Chemical and physical properties of site contaminants
- Receptor populations and critical habitats

The results of the preliminary risk evaluation will be used in decisionmaking about future actions at each of the nine GANGB sites. These decisions will be based on an evaluation of the constituents detected during the SI, their relationship to source activities, the potential for exposure to these constituents, and the toxicological significance of the constituents.

5.1 ABSTRACT

Exposure to contaminants at GANGB are limited because this site is an industrial setting with restricted access; onsite shallow groundwater is not used for water supply, but shallow wells reportedly exist within about 1 mile of the base, and the GAEPD has indicated that they consider the shallow groundwater as a potential drinking water source; and onsite surface water consists primarily of small drainageways that would not be used for swimming, drinking, or fishing. However, potential migration of contaminants offsite or to the deeper potable aquifer could result in increased exposures.

Contaminants were reported in soil, groundwater, surface water, and sediment at various locations. The types of contaminants reported include priority pollutant metals, VOCs, and PAH compounds. The data as summarized at various site locations do not necessarily represent average contaminant levels or worst case levels of contamination. The sampling strategy at several locations determined the areal extent of contaminated soils, without analysis of the more highly contaminated samples. Although basewide detections of metals in groundwater could influence the remedial actions at each of the sites, some sites and operable units within those sites showed unique types and levels of contaminants with a greater potential for adverse affects, and therefore these sites require additional investigation.

5.1.1 RISK OF EXPOSURE TO METALS

Metal concentrations reported in the soil samples were typically within ranges considered common for these naturally occurring elements, and the distribution among the sites suggests these are typical levels for these soils. In addition, because the frequency and duration of contact with soils by GANGB personnel will probably be limited, adverse impacts are not likely to occur.

Metals were reported in the groundwater samples from the background well (09-MW-05) and from shallow monitor wells at each of the sites where groundwater was analyzed. Although arsenic was below the MCL at each site where it was detected, in some samples arsenic concentrations were above the 10^{-6} excess lifetime cancer risk level for potable use. Concentrations of the metals that exceeded a current standard guidance concentration or a 10^{-6} excess lifetime cancer risk level for potable use are summarized below by site:

Site No.	Metals That Exceeded Applicable Standards or Health Criteria
1	Lead, arsenic
5	Arsenic, beryllium, chromium, lead
6	Chromium, lead, selenium
8	Arsenic, beryllium
9	Arsenic, beryllium, chromium, lead
10	Beryllium, chromium, lead
11	Beryllium, chromium, lead

In the sample from the background well (09-MW-05) concentrations of beryllium, chromium, and lead exceeded the levels considered protective for potable use. The concentrations of metals detected in this sample are listed below:

Metal	Concentration (μg/l)
Beryllium	12
Cadmium	0.5
Chromium	74
Copper	60
Lead (unfiltered)	22
Mercury	0.3
Silver	11
Zinc	80

The pattern of the metal distribution in groundwater (the concentration ranges and the well locations) is ubiquitous and non-site specific, and therefore does not suggest a specific source(s) of these constituents. This pattern may be attributed to the acidic groundwater conditions (pH ranging from 4.1 to 5.6), which result in higher metal

solubility. Because pH and concentrations of dissolved solids would typically increase as the groundwater is transported to the lower aquifer, these metals may be attenuated. Therefore, transport of metals offsite or to the deeper aquifer does not appear to be relevant to GANGB. The acidity of the groundwater may limit the potable use of shallow groundwater because the concentrations of metals may exceed acceptable regional levels.

Metals were reported in the surface water (drainageway) samples from Site No. 1, Site No. 8, and Site No. 9. Because these surface waters are not used for potable water supply or recreational uses, potential impacts to human health are limited. However, metal concentrations exceeded water quality criteria for protection of aquatic life in samples from several locations in the onsite drainageways.

Metals in sediments at several areas were at higher concentrations than source soils for selected metals. Drainageways tend to accumulate metals transported with the fine particles in the surface water runoff or from direct discharges. Stormwater runoff from large areas of the base into the drainageways contribute nonpoint source discharges which are not easily focused in the SI. Direct human exposure to sediments are limited and specific connection to the sources identified during the SI were not made.

5.1.2 RISK OF EXPOSURE TO ORGANIC COMPOUNDS

Organic compounds were identified at the following sites and operable units:

Site No.	Organic Compound Detected
1	TCE in sediment (1.9-5.3 μg/kg) Toluene in soil (1.3 μg/kg)
2	PAH compounds in sediment
5	Fuel constituents such as benzene, toluene, ethylbenzene, xylenes, and naphthalene in soil and groundwater
6	Toluene in soil (1.3 μg/kg)
7	Toluene in soil (2.8 μg/kg) Xylenes in groundwater (3.8 μg/l) Naphthalene in groundwater (5 μg/l)
8	Various chlorinated solvents in soil, groundwater, surface water, and sediment TCE as high as 69,000 μg/l in groundwater
9	Fuel constituents primarily in groundwater
10	Chlorinated solvents and fuel constituents such as 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene, and benzene in groundwater
11	Fuel constituent such as benzene, toluene, xylenes, and naphthalene in soil and groundwater

A primary pathway of concern for VOCs is typically contact with contaminated groundwater. Another potential pathway is releases to the air following spills, which may result in temporarily elevated air concentrations. Because VOCs are not expected to persist in surface soil, surface water, and sediment, the potential for environmental impacts is decreased. However, VOCs can persist in groundwater and could migrate offsite. The transient detections of VOCs in the surface soil, surface water, and sediment samples may be attributed in part to ongoing airport activities that result in elevated air concentrations. Concentrations of VOCs at Site No. 1, Site No. 2, and Site No. 6 do not appear to pose a significant risk.

Site No. 8 poses the greatest potential for risks associated with the presence of VOCs. High concentrations of chlorinated solvents were reported, which could vertically migrate to the deeper aquifer used in the area for water supply. The vertical and horizontal extent of contamination has not been clearly defined, and not enough information is available to determine if there is an imminent threat to water supply wells.

Fuel constituents (lower molecular weight aromatic constituents, including naphthalenes) were identified in samples from several monitor wells at concentrations above acceptable levels for potable use. Because the fuel constituents are less dense than water and the water table is shallow at GANGB, these constituents will likely be retained near the soil surface where volatilization and possible biodegradation could occur. Therefore, where the concentrations of fuel constituents appear to be surficial and localized, transport may be limited and natural attenuation may further reduce the concentrations. An imminent threat from fuel constituents is not anticipated at the nine sites.

Although, naphthalenes are considered PAH compounds, they have properties (solubility and volatility) intermediate between the properties of aromatic VOCs and the other PAH compounds. At the nine GANGB sites, naphthalenes tend to be associated with VOC fuel components detected in groundwater.

PAH compounds, other than naphthalenes, were reported in sediment samples from Site No. 1, Site No. 2, and Site No. 8 and in a soil sample from Site No. 2. These PAH compounds tend to be retained in sediment and soil, and because they have a low water solubility, concentrations of these compounds are typically low in groundwater and surface water. Although several of these PAH compounds are classified as B2 carcinogens, human contact with contaminated sediment is expected to be very limited, particularly given the current land use and size and use of the drainageways. In addition, because these PAH compounds have only a limited tendency to bioaccumulate, they are metabolized and their mobility is limited.

5.2 SELECTION OF THE CHEMICALS OF CONCERN

This preliminary risk evaluation was based on the data collected during the SI. The analytical data collected were validated using the procedures described in Section 4. After data validation, the data were reviewed to eliminate results that could represent contamination of samples in the laboratory or in the field or that failed to meet quality control guidelines. Data with J qualifiers that met data validation requirements were used in this evaluation as recommended by EPA (1989a). This qualifier suggests certainty in chemical identification, but uncertainty in chemical quantification. The initial data screening involved the following reviews:

- The results of the duplicate analyses were reviewed to determine if there were any major inconsistencies.

- Chemical concentrations in rinsate blanks, field blanks, and the decontaminated water were compared to field sample concentrations to determine if chemicals identified in the field samples could have been introduced during sample collection or analysis procedures. The highest concentration of any chemical detected in blank water samples were the following:

    - 18 μg/l dichloromethane (150 μg/l detected in rinsate blank on 9/14/90)

    - 0.14 μg/l beryllium

    - 3 μg/l chromium

    - 20.2 μg/l copper

    - 4 μg/l lead (unfiltered)

    - 0.2 μg/l mercury

    - 44 μg/l zinc

- The results of the analysis of matrix spikes and matrix spike duplicates were reviewed. Several matrix spike analytes were reported outside the control limits for metals for several samples (low % recovery). These metals included antimony (four samples), selenium (three samples), zinc (one sample), arsenic (one sample), and thallium (one sample). These data received an R qualifier during the data validation and were not included in the preliminary risk evaluation. Antimony and thallium were not detected in any samples collected.

Dichloromethane is a common contaminant in blanks and may not be associated with site activities. Positive data for this chemical less than ten times the highest blank concentration were eliminated from the list of chemicals of potential concern. Other chemicals were removed from the evaluation if their concentrations were less than five times the highest blank concentration (EPA 1989).

Background soil and sediment samples were not collected for comparison with the samples collected at the GANGB site. The U.S. Geological Survey (Shacklette and Boerngen, 1984) lists the range and mean concentrations of metals in soils in the United States. Data for the eastern United States were used as background values for comparison with the SI soil data. Background concentrations for organic chemicals in soil samples were assumed to be zero.

5.3 BASEWIDE EXPOSURE ASSESSMENT SUMMARY

Exposure assessment is the determination or estimation, qualitative or quantitative, of the exposure magnitude, frequency, duration, and route. This subsection identifies the means by which people can come into contact with chemicals from the nine GANGB sites. It addresses exposures under current site conditions and exposures that could result from potential future uses of the site and the surrounding area.

An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual. An exposure pathway consists of four elements: (1) a source and mechanism of chemical release, such as a storage tank leak or spill; (2) a retention or transport medium such as soil or sediment, air, or water; (3) a point of potential human contact, the exposure point, with the contaminated medium; and (4) an exposure route such as ingestion or inhalation. If one component of the exposure pathway is missing then the exposure of an individual to a toxic substance will not take place.

Human exposure to contaminants can occur through the use of groundwater as a drinking water supply. In residences, people can be exposed to contaminants from ingestion of the water used for drinking and cooking. They can also be exposed through dermal absorption of contaminants, primarily during bathing and showering, and inhalation of volatile compounds released from the water into the air during irrigation, showering, bathing, cooking or by the use of household appliances such as washing machines. Employees and patrons of businesses that use the groundwater can also be exposed.

The direct contact exposure pathway involves the physical contact of receptors with the waste material or contaminated soil. The routes of exposure associated with direct contact are typically ingestion and dermal absorption. Direct contact can also

occur during site development. The degree of this potential contact depends on the following:

- The location and extent of the excavation
- The deposition of excavated material, left onsite or taken offsite for disposal
- The amount of material excavated
- The particular type of site use

Commercial or light industrial development, such as a aircraft maintenance, office, or storage areas, would have a relatively low potential for future direct contact because after these developments were completed, access to contaminants would be limited as much of the site would be covered by buildings and parking lots. Potentially exposed individuals would most likely be maintenance personnel or utility workers.

5.3.1 LAND USE

Information regarding current and future land use in the vicinity of the GANGB is based on the *Georgia Air National Guard Master Plan* and the *Savannah Municipal Airport Master Plan and Land Use Compatibility Plan*. To the north and northwest of the airport, property is unincorporated and predominantly undeveloped. Some of this land is used for agriculture and commercial forestry. There are also some wetlands in this area. Within 1 mile of the airport, to the northeast, is a city-owned industrial water-filtration plant, a correctional institute, railroad lines, and a cemetery. The Port Wentworth city limits are beyond these facilities.

GANGB leases approximately 232 acres of land from the Savannah International Airport. This overall land use of this area is expected to remain commercial and industrial. The Master Plan for GANGB indicates that it will remain in its current location through mid-year 2035. Although the general layout of the base will not change significantly in the near future, future growth and alterations will require restructuring of the land uses and infrastructure of the base.

There are currently eight categories of land use at GANGB:

- Restricted safety zones
- Airfield pavements
- Aircraft maintenance
- Aircraft operations

- Industrial--civil engineering, supply, and vehicle operation and maintenance facilities

- Command and support

- Special categories--munition, facilities, small arms ranges, storage igloos, hazardous waste storage facilities, and fire-training facilities

- Open space

Adjacent to the base, land use varies from residential to industrial. Facilities in the surrounding area include airport operations to the west and north and the county prison to the east of the 165th Tactical Airlift Group apron.

The Master Plan for GANGB includes constraints to development of wetlands and IRP sites.

5.3.2 GROUNDWATER USE

Some residents within a mile of the Savannah International Airport may derive their drinking water from the Floridan aquifer. In addition, GAEPD has indicated that they consider shallow groundwater as a potential source of drinking water. Beds of clay above and below this aquifer may confine the water in the limestone and may help protect the aquifer from surface contamination. Wells are usually cased at the top part of the limestone and extend below the casing.

The City of Savannah maintains wells at three sites on the Savannah International Airport property. Well 17, located southeast of the main terminal building, is the principal well. It is 500 feet deep and has a main pump rated at 1,500 gallons per minute (gpm) and a booster pump rated at 1,000 gpm. Well 18 is near the Quality Inn. Well 19 is located within the leased limits of GANGB near Building #178. It has no backup tank and is only used for emergency standby, if the primary well pump systems fail.

The surficial aquifer beneath GANGB consists of permeable sands with a high water table and is therefore susceptible to contamination. The aquifer may be a potable water source for nearby residents and is a recharge source for Pipemakers Canal and the Savannah River. Shallow wells have reportedly been installed within about 1 mile of the base.

5.3.3 SURFACE WATER USE

GANGB is within the drainage basin of the Savannah River. Surface runoff, drainages, and groundwater recharge into these ditches from GANGB and the Savannah International Airport contribute to the flow of the Savannah River by way of Pipemakers Canal. Stormwater runoff from the Savannah International Airport

area is currently collected by a system of ditches, culverts, swales, and paved canals that outfall into Pipemakers Canal, which runs southwest and south of the airport.

Pipemakers Canal is approximately 12 miles long and flows west to east. The canal receives treated waste from approximately 8,000 persons, mainly from the Towns of Bloomingdale and Pooler, and from several industrial sewer systems.

5.3.4 CONTAMINANT FATE AND TRANSPORT

The exposure to contaminants at GANGB is affected by the potential migration and attenuation of the constituents reported at the nine sites. Three major categories of contaminants were reported during the SI: VOCs, PAH compounds, and metals. The general properties of these constituents are discussed below.

VOCs are generally mobile in groundwater and tend to volatilize from surface soils and water. Because of their high volatility, VOCs may transfer from one medium to another, which could result in releases from the source areas to the air and potential exposures from inhalation. VOCs may be present in detectable concentrations in the air in areas like airports where fuels and solvents may be commonly used. Trace concentrations of VOCs may represent air deposition or contamination from the air during sample collection. Low levels of dichloromethane likely represent laboratory contamination.

PAH compounds are present in fuels, coal tars, crude oils, and wastes from the incomplete combustion of fuels and other organic matter. The chemicals are typically solid at room temperature, with water solubilities ranging from a high of 31 mg/l for naphthalene to a low of 0.00014 mg/l for indeno [1,2,3-cd] pyrene. These constituents, particularly those of higher molecular weight, tend to sorb to soils or sediments. Volatilization can be important in surface waters for attenuation of some of the compounds, such as naphthalenes and fluorene. Although PAH compounds do not undergo hydrolysis, they are susceptible to photolysis in surface waters and near-surface soils. Biotransformation in soil-water environments may occur at low rates.

Many metals are attenuated in groundwater from processes like cation exchange, sorption, and precipitation. Chromium may exist as an anion in solution, resulting in greater mobility. Particulates in groundwater samples may result in elevated concentrations of metals in the samples.

5.4 TOXICITY ASSESSMENT

Toxicity assessment has two general steps. The first step, hazard identification, is the process of determining what adverse health effects, if any, could result from exposure to a particular chemical. The second step, dose-response evaluation, quantitatively

examines the relationship between the level of exposure and the incidence of adverse health effects in an exposed population.

For this risk evaluation, human health effects were divided into two categories: carcinogenic effects and noncarcinogenic effects. Chemicals with carcinogenic effects frequently also have noncarcinogenic effects.

EPA has developed a carcinogen classification system (1986a) that uses a weight-of-evidence approach to classify the likelihood of a chemical being a human carcinogen. Information considered in developing this classification system included human studies of the association between cancer incidence and exposure, as well as long-term animal studies under controlled laboratory conditions. Other supporting evidence considered included short-term tests for genotoxicity, metabolic and pharmacokinetics properties, toxicological effects other than cancer, structure-activity relationships, and physical and chemical properties of the chemical. Chemicals are classified by EPA using the following designations:

- A--Human carcinogen
- B1--Probable human carcinogen, limited human data are available
- B2--Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans
- C--Possible human carcinogen
- D--Not classifiable as to human carcinogenicity
- E--Evidence of noncarcinogenicity for humans

Noncarcinogenic health effects include a variety of toxic effects on body systems, ranging from renal toxicity to central nervous system disorders. It is believed that organisms might have protective mechanisms that must be overcome before a toxic endpoint (effect) is manifest. The toxicity of a chemical is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations.

Appendix H presents toxicity profiles for selected chemicals of potential concern at the GANGB sites. The profiles describe four categories of potential toxic effects: acute toxicity, chronic toxicity, carcinogenicity, and other effects. Detailed profiles can be found in the toxicological literature.

ARARs for the site contaminants are discussed in Section 1. The MCL is an enforceable limit, under the Safe Drinking Water Act, on the amount of a substance that is in water delivered to any user of a public water supply system. MCLs are set as close as possible to MCLGs, considering technical and economic feasibility.

MCLGs are human health goals at which no known or anticipated adverse effects are expected to occur. The State of Georgia has identified certain contaminants with MCLs that apply to groundwater. Representatives of GAEPD have also indicated that the standards apply to all groundwater without distinguishing between drinking water and nondrinking water sources. GAEPD has also indicated that nonregulated contaminants should be compared to background concentrations in assessing if a release of hazardous constituents has occurred.

The State of Georgia has adopted surface water quality standards intended to protect their designated use, which includes propagation of fish, shellfish, game, and other beneficial aquatic life. No quantitative regulatory criteria are available for evaluating potential ecological impacts of contaminants in groundwater, sediments, and soils. The potential for ecological impacts related to contamination at GANGB sites was therefore evaluated by comparing sample concentrations to surface water quality criteria.

In contrast, risk levels are an attempt to quantify the risk associated with exposure to a specified dose or concentration. For example, slope factors are the risk of excess cancers occurring in a population, as a function of dose, above some baseline level expected for that population. Specifically, the slope factor is the slope of the line that defines the 95th percent upper confidence limit on the dose-response curve from a study or collection of studies on the carcinogenicity of a particular substance. Slope factors are preferentially based on studies in humans, such as epidemiological studies, but are often based on toxicological studies in animals and may be supported with *in vitro* genotoxicity studies of mammalian, insect, and microbial cells.

Multiplication of the slope factor by a specific dose of a substance yields a unitless value that represents the probability that an individual will develop cancer after exposure to that dose over a lifetime. Multiplication of the unit risk by the concentration of a substance in air or water yields a unitless value that represents the probability that an individual will develop cancer after exposure to that concentration over a lifetime. These estimates of excess lifetime cancer risks were not calculated in this preliminary evaluation.

Toxicity depends on the dose or concentration of the substance, i.e., the dose-response relationship. Toxicity values are a quantitative expression of the dose-response relationship for a chemical. Toxicity values take the form of reference doses (RfDs), slope factors, and unit risks, each of which are specific to exposure through different routes.

Two primary sources of toxicity values were used in this evaluation. The primary source was EPA's Integrated Risk Information System (IRIS) database. IRIS is an EPA data base containing up-to-date health risk and EPA regulatory information. IRIS contains only those RfDs and slope factors that have been verified by EPA work groups and is considered by EPA to be the preferred source of toxicity information. If a toxicity value was not available through IRIS, the next data source consulted was

the most recently available Health Effects Assessment Summary Tables (HEAST) issued by the EPA's Office of Research and Development (1989b). HEAST summarizes interim and some verified RfDs and slope factors.

The toxicity value describing the dose-response relationship for noncarcinogenic effects is the RfD. Three categories of RfD are potentially available: chronic RfDs (RfD_o for oral, and RfD_i for inhalation), subchronic RfDs (RfD_s), and developmental toxicant RfD (RfD_{dt}). The RfD is generally expressed in units of milligram per kilogram of body weight per day (mg/kg-day). Inhalation RfDs may be expressed as either mg/kg-day or mg/m^3.

EPA defines a chronic reference dose (RfD) as an estimate, with uncertainty spanning approximately one order of magnitude or greater, of a daily exposure to the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (as a Superfund program guideline, 7 years to lifetime).

RfDs for some inorganic compounds are for specific forms, such as, hexavalent and trivalent chromium. The CLP analyses do not, however, report concentrations of specific forms, but give results in terms of the "total" inorganic chemical. In such situations, it was conservatively assumed, unless otherwise known, that the most toxic form was present and its RfD was used.

Table 5-1 lists the EPA classifications and the slope factors for the potential carcinogens at the nine GANGB sites, and Table 5-2 lists the RfDs for the potential chemicals of concern. Arsenic and beryllium are two naturally occurring elements that have high oral slope factors according to information in IRIS. Ingestion of groundwater or soil may be considered a potential route of exposure for these chemicals. However, beryllium is so poorly absorbed from the gut that ingestion has not been unequivocally shown to induce a carcinogenic response. The Agency for Toxic Substances and Disease Registry (ATSDR, 1988) cites three studies of oral administration of beryllium in rats that support the contention that poor absorption significantly reduces the hazard of oral ingestion. The IRIS oral slope factor for beryllium (4.3 mg/kg-day) does not consider the low absorption and provides a very conservative estimate of the carcinogenic potential of beryllium.

Arsenic concentrations as high as 43 μg/l are not outside the range of concentrations that might be released from natural sources (ATSDR, 1988). Concentrations above 10 μg/l have been found in major river basins including the Missouri, Lower Mississippi, Colorado, Western Gulf, Pacific Northwest, and Great Basin. Estimates of arsenic ingested through drinking water are between 5 and 4,000 μg/day. The highest exposure levels are expected from private wells in areas of naturally high background levels of arsenic. Anthropogenic emissions of arsenic occur primarily from fossil fuel combustion, pesticide use, and copper smelting and result in the deposition of approximately 95,000,000 pounds/year on land. Therefore, risk

Table 5-1
EPA Weight-of-Evidence
Classifications and Slope Factors for
Potential Carcinogens at the Georgia Air National Guard Base

Chemical	Weight-of-Evidence Group	Slope Factor (mg/kg-day)	Source
Arsenic	A	1.75[a]	HEAST, 12/90
Benzene	A	0.029	IRIS, 1990
Benzo[a]anthracene	B2	ND	HEAST, 12/90[b]
Benzo[a]pyrene	B2	11.5	HEAST, 12/90
Benzo[a]fluoranthene	B2	ND	HEAST, 12/90[b]
Benzo[g,h,i]perylene	B2	ND	HEAST, 12/90[b]
Beryllium	B2	4.3	IRIS, 1990
Cadmium	B1	6.1[d]	IRIS, 1990
Chromium	A	41[d]	IRIS, 1990
Chrysene	B2	ND	HEAST, 12/90[b]
Dibenzo[a,h]anthracene	B2	ND	HEAST, 12/90[b]
1,4-Dichlorobenzene	C	0.024	IRIS, 1990
1,1-Dichloroethane	C	ND	HEAST, 12/90
1,1-Dichloroethene	C	0.6	IRIS, 1990
Indeno[1,2,3-cd]perylene	B2	ND	HEAST, 12/90[b]
Lead	B2	ND	IRIS, 1990
Nickel	A	0.84[d]	IRIS, 1990
1,1,2-Trichlorothane	C	0.057	IRIS, 1990
Trichloroethene	B2	0.017	HEAST, 12/90

[a] Slope factor calculated from the oral unit risk recommended for adoption by the Administrator of the EPA (IRIS, 1990)
[b] Risk estimates for other carcinogens based on benzo[a]pyrene.
[c] Slope factor based on Federal Ambient Water Quality Criteria (1980) estimates for PAH compounds.
[d] Inhalation slope factor. Oral slope factor is not determined, although there is adequate evidence for carcinogenicity of this compound by oral route.

mg/kg-day = milligram per kilogram of body weight per day
ND = Not determined

Table 5-2
Reference Dose Values (RfDs) for the Chemicals of Concern at the Nine GANGB Sites

Chemical	RfD (mg/kg-day)
VOCs	
Ethylbenzene	0.1[a]
Xylene	2[a]
Toluene	0.2[a]
Trichloroethene	ND
1,1-Dichloroethane	1[b]
1,1-Dichloroethene	0.0009[a]
1,1,1-Trichloroethane	0.09[a]
1,1,2-Trichloroethane	0.004[a]
1,2-Dichlorobenzene	0.09[a]
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
PAH Compounds	
Naphthalene	0.004[b]
1-Methylnaphthalene	ND
2-Methylnaphthalene	ND
Fluorene	0.04[b]
Phenanthrene	ND
Fluoranthene	0.04[b]
Pyrene	0.03[b]
Benzo[a]anthracene	ND
Chrysene	ND
Benzo[b]fluoranthene	ND

Table 5-2
Reference Dose Values (RfDs) for the Chemicals of Concern at the Nine GANGB Sites

Chemical	RfD (mg/kg-day)
PAH Compounds (continued)	
Benzo[a]pyrene	ND
Indeno[1,2,3-cd]pyrene	ND
Dibenzo[a,h]anthracene	ND
Benzo[g,h,i]perylene	ND
Priority Pollutant Metals	
Arsenic	0.001[b]
Beryllium	0.005[a]
Cadmium	0.0005[a]
Chromium	0.005[a]
Copper	ND
Lead	ND
Mercury	0.0003[b]
Nickel	0.02[b]
Selenium	0.03[b]
Silver	0.003[a]
Zinc	0.2[b]

[a]Source: IRIS, 1990
[b]Source: HEAST, 12/90

ND = Not determined

assessment and subsequent risk management depend on the identification of the arsenic source. An oral unit risk (5 x $10^{-5}/\mu g/l$) has also been developed based on an increased incidence of skin cancers in humans associated with arsenic in drinking water. The Administrator of EPA has recommended that the oral unit risk be adopted (IRIS, 1990). The oral unit risk for arsenic corresponds to a slope factor of 1.75 (mg/kg-day).

5.5 ENVIRONMENTAL SETTING

5.5.1 BIOTIC COMMUNITIES

The GANGB Master Plan identified three distinct community types on and adjacent to the facility. Most of the GANGB property is characterized as a disturbed-maintained community, in which species composition is strongly affected by past and ongoing human activities. Vegetation is dominated by grasses, hedges, shrubs, palmettos, and pine trees. A pine-forest community adjacent to GANGB property, east of State Route 307, has been fragmented by roads, railroads, and other construction. Areas of mixed forest are found adjacent to the east and south sides of GANGB property. The mixed-forest vegetation is dominated by pines and hardwood trees in the canopy, sub-canopy, and herbaceous layers, but grasses, vines, and shrubs are also common in these areas. A wetland area is within GANGB boundaries, adjacent to the west side of State Route 307.

No comprehensive wildlife surveys have been reported for GANGB property. A 1977 study of a mixed-forest community near Savannah Municipal Airport property documented a total of 194 animal species, comprised of 133 birds, 16 amphibians, 28 reptiles, and 17 mammals.

The 1983 Master Plan for Savannah Municipal Airport indicated that disturbed maintained areas primarily provide habitat for highly mobile or adaptable species, such as the mockingbird, crow, house sparrow, eastern cottontail, opossum, eastern mole, shrew, and numerous rodents, including mice and rats. Forest-dwelling mammals reported to occur on airport property included the gray squirrel, fox squirrel, raccoon, and white-tailed deer. The fox and bobcat were not documented on airport property, but they were also considered likely to occur there. The southern copperhead, eastern cottonmouth, and canebrake rattlesnake have been reported near ditches and canals in forest habitat near the municipal airport.

5.5.2 THREATENED AND ENDANGERED SPECIES

Nine animal species and seven plants that are designated as threatened or endangered by federal or state statutes are reported to occur in Chatham County habitats similar to those found in the vicinity of GANGB property. The 1983 Savannah Municipal Airport Master Plan indicated that six federally protected animal

species have historically been reported in the vicinity of the airport: American alligator, indigo snake, eastern brown pelican, southern bald eagle, American peregrine falcon, and Bachman's warbler. The alligator is currently listed as threatened because it is similar in appearance to other crocodilians; in Georgia, the alligator is not threatened or endangered.

No federally listed plants were reported to occur near the airport in the 1983 Savannah Municipal Airport Master Plan, and no state or federally listed plants or animals were reported on GANGB property in the 1990 GANGB Master Plan. Sherman's pocket gopher, which is classified as endangered by the State of Georgia, was historically found in the area. However, no Sherman's pocket gophers have been reported in the area since 1939, and it appears unlikely that this gopher still exists on municipal airport or GANGB property.

5.6 SITE NO. 1--CRTC HANGER AND WASHRACK DISCHARGE POINT

5.6.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.6.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at one location
- Groundwater--samples from two monitor wells
- Surface water--four samples from the drainageway
- Sediment--twelve samples from the base of the drainage ditch.

Table 5-3 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. Dichloromethane, which is a common laboratory artifact, was the only chemical listed in Table 5-3 that was not considered a preliminary chemical of concern at this site. Table 5-4 summarizes the range of detected concentrations for each medium.

5.6.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 1 are affected by several factors:

- The GANGB Master Plan indicates that the base will remain in its current location through mid-year 2035. Access to the base is restricted in some areas.

Table 5-3
Summary of Positive Detections
Site No. 1--CRTC Hanger and Washrack Discharge Point

Page 1 of 2

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (μg/kg)				
Volatile Organic Compounds				
Toluene	1/2	1.2	1.3	NA
Priority Pollutant Metals				
Chromium	2/2	NA	3,600 - 12,000	52,000
Lead	2/2	NA	3,100 - 9,000	17,000
Nickel	1/2	2,600	4,200	18,000
Zinc	2/2	NA	1,000 - 6,600	52,000
Groundwater (μg/l)				
Priority Pollutant Metals				
Cadmium	1/2	0.2	0.5	0.5
Chromium	2/2	NA	11 - 36J	74
Lead	2/2	NA	9 - 23J	22
Silver	1/2	10	30	11
Zinc	2/2	NA	10 - 60	80
Surface Water (μg/l)				
Volatile Organic Compounds				
Dichloromethane	1/4	1.0	1.7	NA
Priority Pollutant Metals				
Arsenic	1/4	5	6	NA
Cadmium	2/4	0.2	0.2 - 0.3	NA
Zinc	2/4	10	10	NA
Sediment (μg/kg)				
Volatile Organic Compounds				
Dichloromethane	10/12	1.2 - 1.4	1.9 - 28	NA
Trichloroethene	2/12	1.2 - 1.5	1.9 - 5.3	NA

Table 5-3
Summary of Positive Detections
Site No. 1--CRTC Hanger and Washrack Discharge Point

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Sediment (µg/kg) (cont.)				
Polynuclear Aromatic Hydrocarbon Compounds				
2-Methyl Naphthalene	1/12	62 - 600	590J	NA
1-Methyl Naphthalene	1/12	62 - 600	720J	NA
Fluorene	2/12	62 - 600	53J - 710J	NA
Phenanthrene	5/12	62 - 74	220 - 3,300	NA
Fluoranthene	6/12	62 - 74	53J - 5,200	NA
Pyrene	6/12	62 - 74	38J - 5,400	NA
Benzo(a) anthracene	5/12	62 - 74	110 - 1,500	NA
Benzo(b) fluoranthene	5/12	62 - 74	86 - 1,500	NA
Benzo(k) fluoranthene	5/12	62 - 74	55J - 950	NA
Chrysene	5/12	62 - 74	180 - 3,600	NA
Benzo(a) pyrene	5/12	62 - 74	140 - 2,000	NA
Indeno(1,2,3-cd) pyrene	5/12	62 - 74	130 - 2,800	NA
Dibenzo(a,h) anthracene	4/12	62 - 370	74 - 920	NA
Benzo(g,h,i) perylene	5/12	62 - 74	91 - 2,000	NA
Priority Pollultant Metals				
Arsenic	10/12	650 - 700	890J - 1,700J	7,400
Beryllium	7/12	570 - 700	640 - 1,300	850
Cadmium	5/12	30	30 - 2,900	1,700
Chromium	12/12	NA	2,200 - 31,000	52,000
Copper	6/12	2,600 - 2,800	2,700 - 10,200	22,000
Lead	12/12	NA	7,400 - 79,600	17,000
Mercury	4/12	20 - 30	20 - 230	120
Zinc	12/12	NA	7,000 - 57,300	52,000

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984).

J = Concentration estimated because quality control criteria wereas not met or amount detected was below detection limit.
NA = Not applicable
µg/kg = micrograms per kilogram
µg/l = micrograms per liter

Table 5-4
Range of Detected Concentrations
Site No 1--CRTC Hangar and Washrack Discharge Point

Chemical	Concentration			
	Soil (μg/kg)	Groundwater (μg/l)	Surface Water (μg/l)	Sediment (μg/kg)
Volatile Organic Compounds				
Trichloroethene	--	--	--	1.9 - 5.3
Polynuclear Aromatic Hydrocarbon Compounds				
2-Methyl Naphthalene	--	--	--	590J
1-Methyl Naphthalene	--	--	--	720J
Fluorene	--	--	--	53J - 710J
Phenanthrene	--	--	--	220 - 3,300
Fluoranthene	--	--	--	53J - 5,200
Pyrene	--	--	--	38J - 5,400
Benzo(a) anthracene	--	--	--	110 - 1,500
Chrysene	--	--	--	180 - 3,600
Benzo(b) fluoranthene	--	--	--	86 - 1,500
Benzo(k) fluoranthene	--	--	--	55J - 950
Benzo(a) Pyrene	--	--	--	140 - 2,000
Indeno(1,2,3-cd) pyrene	--	--	--	130 - 2,800
Dibenzo(a,h) anthracene	--	--	--	74 - 920
Benzo(g,h,i) perylene	--	--	--	91 - 2,000
Priority Pollutant Metals				
Arsenic	--	--	6.0	890J - 17,000
Beryllium	--	--	--	640 - 1,300
Cadmium	--	0.5	0.2 - 0.3	30 - 2,900
Chromium	3,600 - 12,000	11 - 36J	--	2,200 - 31,000
Copper	--	--	--	2,700 - 10,200
Lead (unfiltered)	3,100 - 9,000	9 - 23J	--	7,400 - 79,600
Mercury	--	--	--	20 - 230
Nickel	4,200	--	--	--
Silver	--	30	--	--
Zinc	1,000 - 6,600	10 - 60	10	7,000 - 57,300

J = Concentration estimated because quality control cirteria were not met or amount detected was below detection limit.
μg/kg = micrograms per kilogram
μg/l = micrograms per liter
-- = Compound was analyzed for but not detected above estimated detection limit.

- The source area is currently under industrial use, the surrounding area consists of various base and airport activities. Site access is not restricted.

- Shallow groundwater is not used for potable water supply at the site, although the water is potentially of potable water quality. Groundwater migrates toward the drainage ditch.

- The washrack consists of a concrete pavement that drains into a central stormwater intake structure. The stormwater line travels southeast under personnel-housing facilities and discharges into an open drainage ditch approximately 200 yards from the washrack.

- The open drainage ditch traverses an open field, emptying into a retainage pond next to GANGB at the Days Inn Motel.

Under current conditions, GANGB personnel are unlikely to contact the chemicals of concern present in the drainage ditch. The public may have increased contact to contaminants that migrate to the canal; however, recreation or fishing areas have not been identified in the canal.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use. In addition, shallow wells have reportedly been installed within about 1 mile of the base. The potentially affected groundwater discharges to a nearby drainageway; therefore, a primary concern about contaminants in groundwater is the potential transport of contaminants and discharge to surface water.

The nature of the site activities and the contaminant behavior influenced the distribution of VOCs, PAH compounds, and priority pollutant metals reported during the SI, and could also influence the future release and transport of these constituents.

Volatile Organic Compounds. The low levels of dichloromethane detected at this site likely represent a laboratory artifact. Other VOCs were only detected in the sediment and soil samples from this site. In the sediment samples, the maximum concentration of trichloroethene detected was 5.3 µg/kg, and in one soil sample, toluene was detected at 1.3 µg/kg.

Trichloroethene would be expected to solubilize from sediments, and subsequently volatilize from surface water. It would not be expected to persist in the surface water column or significantly bioconcentrate. Because trichloroethene was reported only in 2 of 12 sediment samples and it was not reported in the groundwater or soil samples, the likely source of this chemical was discharges directly into the drainageways. Since several areas discharge into the drainageway, the washrack may or may not be the source of the trichloroethene.

The low levels of VOCs reported at this site do not suggest that site activities are a significant source for VOCs, and therefore the air pathway was not considered a pathway of concern for VOCs at this site.

Polynuclear Aromatic Hydrocarbons Compound. PAH compounds were not reported in the soil, groundwater, or surface water samples. These compounds are not expected to readily transport in groundwater. PAH compounds were reported in approximately half of the sediment samples, and these compounds were likely discharged directly to the drainageways from stormwater runoff or activities at the washrack. The PAH compounds reported in the sediment samples generally represented the higher molecular weight compounds that are more persistent. PAH compounds tend to be metabolized, and therefore bioconcentration is reduced.

Concentrations of PAH compounds were highest at the discharge point to the drainage ditch (01-SS-12). However, the third highest concentration was at the most downstream sample location (01-SS-01). The concentrations reported were near the detection limits for most of the samples.

Transport offsite of these constituents may occur with sediment migration or subsequent discharges from roads downstream of the discharge point. Basewide and offsite activities other than activities at the washrack may contribute to releases of PAH compounds.

Priority Pollutant Metals. Various metals were reported in each of the media evaluated during the SI, and some of these detections may be attributed to naturally occurring levels. The soil samples contained chromium, lead, nickel, and zinc at concentrations below typical background levels. Concentrations in the sediment samples were higher than those in the soil samples.

Many metals are attenuated in groundwater from processes like cation exchange, sorption, and precipitation. Chromium may exist as an anion in solution, resulting in greater mobility. Particulates in groundwater samples may result in elevated concentrations of metals in the samples, and therefore the concentrations detected may not necessarily be representative of the mobility of these constituents. Lead was reported at 23 μg/l in an unfiltered sample, but was less than 0.002 μg/l in the associated filtered sample. Groundwater at the site is acidic (pH 4.1 to 5.6), which may account for regional elevated metal concentrations. The concentrations of priority pollutant metals in groundwater at Site No. 1 were similar to levels measured in the background well (09-MW-05).

Metals reported in surface water samples were at concentrations similar to those reported in the groundwater samples. It is likely that the elevated metals detected in the surface water resulted from direct discharges of groundwater into the drainage ditch and stormwater runoff. The metal distribution in the drainageway does not suggest major deposition of metals near the discharge point to the ditch. although cadmium, lead and zinc concentrations in the sediment were highest at that point

(01-SS-12). Cadmium and zinc concentrations were elevated in the downstream surface water and sediment samples. Beryllium was only reported in sediment samples collected downstream from the discharge point.

5.6.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are presented in Appendix H. Arsenic, beryllium, lead, TCE, and several of the PAH compounds detected at Site No. 1 are known or suspected carcinogens by the ingestion pathway.

The following samples had concentrations that exceeded the potential ARARs:

Matrix	Sample Number	Chemical	Sample Concentration	Potential ARAR Criterion
Groundwater	01-MW-02	Lead	23 µg/l	Proposed MCL (5 µg/l) Current EPA Region IV Guidance (15 µg/l)
Surface Water	01-SW-04	Arsenic	6 µg/l	FAWQC for protection of human health from consumption of fish (10^{-6} cancer risk of 0.0175)

5.6.1.4 Risk Screening

Soil. One sample location was evaluated for site-related contaminants. Although toluene was detected at 1.3 µg/kg in a soil sample, it was not detected in the groundwater samples, suggesting that the washrack was not a primary source for this constituent. Several metals were reported in the soil samples at levels below typical background levels. At this site, exposures would be limited to GANGB personnel working in the area.

Direct contact exposures to GANGB personnel are not expected to be a concern. Concentrations of metals detected in the soil samples were generally below those detected in the sediments samples, suggesting that the soils are not a significant source for runoff into the surface water. A change in the use of this site may increase exposure to soils, but based on the observed concentrations, it is unlikely that other site uses would result in unacceptable risks.

Groundwater. No organic constituents were reported in groundwater samples collected during the SI. Several metals were reported in the unfiltered groundwater samples at concentrations similar to background levels and below the drinking water standards. Lead was reported at 23 µg/l in one sample, which exceeded the EPA Region IV guidance concentration of 15 µg/l. Lead was below detectable levels in the

filtered sample. Although arsenic was below the MCL, it exceeded the 10^{-6} risk level for ingestion of a potable water supply.

The shallow groundwater is not used for potable water supply at the base, and the metals are not likely to be highly mobile. Groundwater discharges to the drainageway. Although the arsenic concentration in a groundwater sample exceeded the FAWQC for protection of human health from consumption of fish, it is unlikely that groundwater discharge to the surface water is a major source of contaminants to the canal.

Surface Water. Exposures by GANGB personnel to contaminants in the surface water would be limited because the drainageway is not believed to be used for recreation or fishing. Contaminants in downstream surface water could potentially result in exposure to the public. Arsenic was the only contaminant reported in the surface water samples that exceeded FAWQC for the protection of human health. This exceedence was detected in the sample collected near the discharge point to the ditch where exposures would be limited. Concentrations in the downstream samples did not exceed the FAWQC for protection of human health.

Sediment. Human exposure to sediments are generally limited. Since the onsite surface water is not used for recreation, GANGB personnel are unlikely to have frequent direct contact exposure. Elevated concentrations of some constituents in sediments may contribute to elevated concentrations in fish tissue. This could be a potential concern in the offsite surface water; however, fishing is not known to occur in this area. The distribution of contaminants in the drainageway suggest that multiple sources may have contributed to the concentrations detected in the sediment samples.

5.6.2 PRELIMINARY ECOLOGICAL EVALUATION

No surface water samples collected at Site No. 1 contained contaminants at levels above applicable State of Georgia water quality criteria. In groundwater samples, concentrations of lead, silver, and zinc were higher than state surface water quality criteria, but these metals do not appear to be migrating to surface water at rates that would affect the levels of metals in the surface water and that represent a significant risk to biota. In addition, these metals may not be related to contamination from Site No. 1, since levels of all three were similar to groundwater concentrations at a background location near the runway (09-MW-05).

5.7 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

5.7.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.7.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at one location
- Groundwater--sample from one monitor well
- Surface water--two samples from the drainageway
- Sediment--four samples from the base of the drainage ditch

Table 5-5 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, and the range of detected concentrations. No constituents listed in this table were eliminated as chemicals of concern. Metals were not analyzed at this site because they were not considered source contaminants based on a description of site activities. Table 5-6 summarizes the range of detected concentrations for each medium.

5.7.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 2 are affected by several factors:

- The GANGB Master Plan indicates the base will remain in its current location through mid-year 2035. Site access is not restricted.

- The source area, which is fenced, is currently under industrial use, the surrounding area consists of various base and airport activities.

- Shallow groundwater is not used for potable water supply at the site, although the water is potentially of potable water quality. Groundwater migrates toward the drainage ditch.

- Washwater from the paved area used to clean vehicles is collected, passed through an oil-water separator, and discharged to an adjacent ditch.

- The drainage ditch is approximately 3 feet wide and 1 to 12 inches deep, with vegetative growth reducing the access. Other ditches intersect the site's drainage ditch about 200 yards downstream. Water may stagnate or percolate at this point. During storm events, surface

Table 5-5
Summary of Positive Detections
Site No. 2--CRTC Vehicle Maintenance Washrack Discharge Point

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations
Soil (µg/kg)			
Polynuclear Aromatic Hydrocarbon Compounds			
Phenanthrene	1/2	58	160
Anthracene	1/2	NA	35J
Fluoranthene	1/2	58	190
Pyrene	1/2	58	180
Benzo(a) anthracene	1/2	58	100
Chrysene	1/2	58	140
Benzo(b) fluoranthene	1/2	58	100
Benzo(k) fluoranthene	1/2	NA	91
Benzo(a) pyrene	1/2	58	86
Sediment (µg/kg)			
Polynuclear Aromatic Hydrocarbon Compounds			
Phenanthrene	1/4	1,400 - 3,100	2,900
Fluoranthene	2/4	1,400 - 3,100	1,000J - 3,300
Pyrene	2/4	1,400 - 3,100	830J - 2,800
Benzo(a) anthracene	1/4	1,400 - 3,100	1,400J
Chrysene	1/4	1,400 - 3,100	2,100
Benzo(b) fluoranthene	1/4	1,400 - 3,100	1,300J
Benzo(k) fluoranthene	1/4	NA	740J
Benzo(a) pyrene	1/4	1,400 - 3,100	1,400J
Indeno(1,2,3-cd) pyrene	1/4	1,400 - 3,100	1,100J
Benzo(g,h,i) perylene	1/4	1,400 - 3,100	920J

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not applicable
µg/kg = micrograms per kilogram

Table 5-6
Range of Detected Concentrations
Site No. 2--CRTC Vehicle Maintenance Washrack Discharge Point

Chemical	Concentration Soil (µg/kg)	Concentration Sediment (µg/kg)
Polynuclear Aromatic Hydrocarbon Compounds		
Phenanthrene	160	2,900
Anthracene	35J	--
Fluoranthene	190	1,000J - 3,300
Pyrene	180	830J - 2,800
Benzo(a) anthracene	100	1,400J
Chrysene	140	2,100
Benzo(b) fluoranthene	100	1,300J
Benzo(k) fluoranthene	91	740J
Benzo(a) pyrene	86	1,400J
Indeno(1,2,3-cd) pyrene	--	1,100J
Benzo(g,h,i) perylene	--	920J

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
µg/kg = micrograms per kilogram
-- = Compound was analyzed for but not detected above estimated detection limit.

water continues to flow east, ultimately emptying into Pipermakers Canal.

Under current conditions, GANGB personnel are unlikely to contact chemicals of concern present in the drainage ditch. The public may have increased contact to contaminants that migrate to the canal; however recreation or fishing areas have not been identified in the canal. The surface water is not used for potable water supply.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use. The potentially affected groundwater discharges to a nearby drainageway; therefore, the primary concern about contaminants in groundwater is the potential transport of contaminants and discharge to surface water.

The nature of the site activities and the contaminant behavior influenced the distribution of PAH compounds reported during the SI, and could also influence the future release and transport of these compounds. The shallow soil sample contained PAH compounds at levels an order of magnitude lower than the levels detected in the samples from the drainage ditch. PAH compounds were not detected in the groundwater sample or deep soil sample. This pattern is consistent with the typically low mobility of these constituents. Several PAH compounds were reported in the sediment sample from the discharge point (SS-04), and two PAH compounds (pyrene and fluoranthene) were reported in the immediate downstream sediment sample (SS-03). PAH compounds were not reported in the two sediment samples collected further downstream.

PAH compounds tend to accumulate in sediment with high organic carbon content. These constituents appear to be concentrated near the discharge point, most likely as a result of direct discharges to the ditch rather than from groundwater discharge. Transport offsite of these constituents may occur with sediment migration. Activities other than those at the washrack may have contributed to releases of these compounds.

5.7.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are in Appendix H. Several of the PAH compounds reported at Site No. 2 are known or suspected carcinogens by the ingestion pathway.

5.7.1.4 Risk Screening

Soil. Several PAH compounds were reported in shallow soil samples collected adjacent to the paved area of the site. The industrial uses at this site would limit potential exposures to GANGB personnel; therefore, the potential threat to human health is limited. The levels detected do not appear to be high enough to account for

the elevated concentrations detected in the samples collected from the adjacent sediments.

Groundwater. Hazardous constituents were not identified during the SI in the shallow groundwater sample. Although groundwater may discharge to the drainage ditch, only low-mobility constituents were reported in the groundwater samples, suggesting that groundwater was not the transport medium.

Surface Water. No hazardous constituents were identified in the surface water samples collected at the site. Human exposures to water in the drainageway are expected to be low since it is not suitable for recreational purposes.

Sediment. Human direct contact exposures to sediment are typically not significant pathways for contact with contaminants. This would be particularly true for drainageways adjacent to industrial activities. Human exposure may occur if the contaminants are transported downstream to areas used by the public, particularly if these constituents resulted in elevated concentrations in fish tissue. PAH compounds were not reported in the downstream samples; therefore the potential impacts may be localized to areas where human exposures are not likely to occur.

5.7.2 PRELIMINARY ECOLOGICAL EVALUATION

VOC and PAH contaminants were not detected in surface water or groundwater samples collected at this site. Elevated levels of several PAH compounds were detected in sediment samples, and these could enter the food chain through sediment consumption by benthic organisms or through consumption of resuspended sediments by filter-feeding organisms. Aquatic biota have not been surveyed at this site; therefore, the significance of this potential exposure pathway could not be evaluated.

5.8 SITE NO. 5--165TH BULK FUEL FACILITY

5.8.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.8.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--six shallow samples, four deep samples
- Groundwater--samples from five monitor wells

Table 5-7 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-7 were considered chemicals of concern except dichloromethane, which is a common

Table 5-7
Summary of Positive Detections
Site No. 5--165th Bulk Fuel Facility

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (µg/kg)				
Volatile Organic Compounds				
Dichloromethane	2/10	1 - 120	3.6UJ - 3.8UJ	NA
Toluene	2/10	1 - 120	1.9 - 29	NA
Ethyl benzene	1/10	1 - 120	28	NA
Total Xylenes	1/10	1 - 120	72	NA
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	2/10	52 - 66	220 - 980	NA
2-Methyl Naphthalene	2/10	52 - 66	250 - 2,000	NA
1-Methyl Naphthalene	2/10	52 - 66	220 - 1,200	NA
***Priority Pollutant* Metals**				
Arsenic	10/10	NA	370 - 11,200	7,400
Beryllium	2/10	590 - 650	74 - 170	850
Chromium	10/10	NA	4,100 - 26,200	52,000
Copper	5/10	1,000 - 1,200	1,200 - 8,100	22,000
Lead	10/10	NA	3,000 - 13,100	17,000
Mercury	2/10	20 - 30	88 - 98	120
Nickel	5/10	2,600 - 3,000	1,300 - 7,200	18,000
Selenium	2/10	1,500 - 1,600	130 - 220	450
Silver	1/10	790 - 1,300	840	2,800
Zinc	10/10	NA	420 - 16,200	52,000

Table 5-7
Summary of Positive Detections
Site No. 5--165th Bulk Fuel Facility

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Groundwater (μg/l)				
Volatile Organic Compounds				
Dichloromethane	2/5	1	1.4 - 2.0	1U
Benzene	1/5	1	25	1U
Ethyl benzene	1/5	1	3.7	1U
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	1/5	2	2	2U
2-Methyl Naphthalene	1/5	2	3	2U
1-Methyl Naphthalene	1/5	2	2	2U
Priority Pollutant Metals				
Arsenic	3/5	5.0J	11J - 43J	NA
Beryllium	1/5	5.0	20	NA
Cadmium	2/5	0.2	0.8 - 0.9	NA
Chromium	5/5	NA	2J - 99J	NA
Copper	2/5	20	20 - 30	NA
Lead	4/5	2	22J - 47J	NA
Nickel	1/5	40	40	NA
Silver	3/5	10	10 - 20	NA
Zinc	5/5	NA	11 - 130	NA

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984).

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
μg/kg = micrograms per kilogram
μg/l = micrograms per liter
NA = Not applicable
U = Compound analyzed for but not detected. Numerical value is the estimated detection limit.

laboratory contaminant. Table 5-8 summarizes the range of detected concentrations for each medium.

5.8.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 5 are affected by several factors:

- The GANGB Master Plan indicates that the base will remain in its current location through mid-year 2035. Access to the site is not restricted.

- The facility is currently under industrial use. The Bulk Fuel Facility is a fenced restricted area. The surrounding land consists of open areas and undeveloped wooded areas. A spill of JP-4 or AVGAS fuel is reported to have migrated to an offsite location.

- Shallow groundwater is not used for potable water supply at the site, although the water is potentially of potable water quality.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use. It has been reported that shallow wells have been installed within about 1 mile of the airport. The primary concern about contaminants in groundwater is the potential transport of contaminants to offsite properties.

The nature of the site activities and the contaminant behavior influenced the distribution of VOCs, PAH compounds, and priority pollutant metals reported during the SI, and could influence future release and transport of these constituents.

Volatile Organic Compounds. VOCs are generally mobile in groundwater, and tend to volatilize from surface soils and water. The low levels of dichloromethane and toluene detected in samples collected at this site likely represent laboratory contamination. The other VOCs that were detected are common fuel constituents (benzene, toluene, ethylbenzene, and xylenes). The analyses of the samples collected during the SI did not suggest that there are widespread high concentrations of fuel residuals. VOC concentrations in water samples were significantly below potential saturation levels.

The initial migration of VOCs is determined by the flow of the fuel product, which may spread vertically and/or horizontally depending on the water saturation and the permeability of the soils at the time of the release.

Polynuclear Aromatic Hydrocarbons Compounds. Naphthalene, which is a common constituent in fuels, was reported in two of the soil samples and one of the groundwater samples, but none of the higher molecular weight PAH compounds were

Table 5-8
Range of Detected Concentrations
Site No. 5--165th Bulk Fuel Facility

Chemical	Concentration	
	Soil (µg/kg)	Groundwater (µg/l)
Volatile Organic Compounds		
Toluene	1.9 - 29	--
Benzene	--	<u>25</u>
Ethyl benzene	28	3.7
Total Xylenes	72	--
Polynuclear Aromatic Hydrocarbon Compounds		
Naphthalene	220 - 980	2
2-Methyl Naphthalene	250 - 2,000	3
1-Methyl Naphthalene	220 - 1,200	2
Priority Pollutant Metals		
Arsenic	370 - 11,200	11J - 43J
Beryllium	74 - 170	20
Cadmium	--	0.8 - 0.9
Chromium	4,100 - 26,200	2J - 99J
Copper	1,200 - 8,100	20 - 30
Lead	3,000 - 13,100	22J - 47J
Mercury	88 - 98	--
Nickel	1,300 - 7,200	40
Selenium	130 - 220	--
Silver	840	10 - 20
Zinc	420 - 16,200	11 - 130

J = Concentration estimated because quality control criteria were not meet or amount detected was below detection limit.
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
-- = Compound was analyzed for but not detected above estimated detection limit.

reported. The concentrations of naphthalene detected in the soil samples were higher than the detected concentrations of VOCs, which may reflect the original fuel composition and the subsequent weathering that would occur following a release.

Priority Pollutant Metals. Various metals were reported in the soil and groundwater samples, and some of these detections may be attributed to naturally occurring levels. The soil samples contained copper, chromium, lead, nickel, and zinc at concentrations below typical background levels. Arsenic was reported in one soil sample at 11.2 mg/kg, which is higher than the typical background level of 7.4 mg/kg, but may represent site background conditions.

The lead detections may be associated with selected fuels, but the other metals detected would not be typically associated with petroleum products. However, presence of petroleum products in soils could change the ambient conditions, e.g., reduce the redox potential, which could then change the solubility of the metals present in that medium.

Several metals were reported in the unfiltered groundwater samples. The distribution of metal detections at this site does not necessarily suggest a plume of metals is present and migrating in the groundwater. These levels may represent conditions in the acidic shallow groundwater and may be the result of particulates in the samples, consistent with basewide observations.

5.8.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are in Appendix H. The following groundwater samples had concentrations that exceeded potential ARARs:

Sample Location	Chemical	Sample Concentration (µg/l)	MCL (µg/l) Final	MCL (µg/l) Proposed	EPA Region IV Guidance (µg/l)
05-EW-108	Benzene	25	5	NA	NA
05-MW-01	Beryllium	20	NA	1	NA
05-MW-01	Chromium	99	50	100	NA
05-MW-04	Cadmium	91	50	100	NA
05-MW-02	Lead	47	50	5	15
05-MW-02	Lead	22	50	5	15
05-MW-03	Lead	23	50	5	15
05-MW-04	Lead	43	50	5	15

NA = Not applicable

5.8.1.4 Risk Screening

Soil. Common fuel constituents were identified in soil samples from one location; however, screening activities suggested more significant contamination may be present in the surficial soils. Direct contact exposures to contaminants in surficial soils would be low. Because no routine activities occur in this area, exposures by GANGB personnel would be infrequent. The offsite locations evaluated in the SI are currently undeveloped wooded areas on which routine exposures would not occur; however, future development of these areas could occur, resulting in increased exposures. The fuel constituents identified in the laboratory analyses of the soil samples did not include known or suspected carcinogens, and the reported concentrations of toluene, ethylbenzene, xylenes, and naphthalene would result in a hazard quotient below 1 for ingestion of soils using residential exposure assumptions for adults (100 mg of soil/day, 70 kg body weight). This suggests that base increased activities at this site would not result in elevated risks. Critical toxicity values are not available for naphthalene. TPH was detected in some of the soil samples, which indicates the presence of higher molecular weight hydrocarbons.

Metals were reported in the soil samples at concentrations lower than typical background levels, although arsenic concentrations were somewhat elevated. A potential source of arsenic in this area has not been identified.

Groundwater. Shallow groundwater is not currently used for potable water at the site and is unlikely to be developed for this purpose in the future. Organic constituents were reported in one of the five groundwater samples. Benzene was reported at 25 μg/l. The current standard for benzene is 5 μg/l, and the State of Georgia applies this standard to groundwater. Ethylbenzene was reported in one groundwater sample at a concentration of 3.7 μg/l. The proposed drinking water standard for ethylbenzene is 700 μg/l. Naphthalene was reported in one groundwater sample at a concentration of 2 μg/l. There are no current or proposed standards available for naphthalene in groundwater. However, based on the RfD for naphthalene of 0.004 mg/kg-day, the hazard quotient for naphthalene would not be exceeded for consumption of water (2 l/day, 70 kg adult) at a concentration of 140 μg/l.

Arsenic and beryllium are known or suspected carcinogens through the ingestion of groundwater pathway. Arsenic was not reported above the drinking water standard, but the maximum concentration reported was above the 10^{-6} risk level. Beryllium, which was reported in one sample, also exceeded this risk level for potable use of the aquifer. Cadmium, silver, and lead were below the current MCLs. Chromium was above the current MCL but below the proposed MCL. The secondary MCLs for copper and zinc were not exceeded. Four unfiltered groundwater samples had concentrations above the current EPA Region IV guidance of 15 μg/l for lead in drinking water. The two filtered samples had concentrations of lead below the detection limits.

Widespread groundwater contamination by fuel constituents was not identified in the SI, and this may be attributed to restricted vertical migration. However, additional monitoring of areas downgradient from the fuel sources may be required to verify that these organic constituents are not migrating offsite. A specific source of metals was not identified at this site; however, elevated metal concentrations appear to be characteristic of the shallow aquifer at GANGB.

5.8.2 PRELIMINARY ECOLOGICAL EVALUATION

Organic contamination, typically associated with aviation fuels was detected along the entire northeast property boundary. The majority of the detections were made in the upper 4 feet of the surficial soils; above a less permeable confining unit. Based on field screening and confirmatory sampling, it appears that in several locations the soils are virtually saturated with fuel remnants. Although soil contamination is present at this site, the potential for exposure or migration appears limited given the known site conditions. Because the majority of the contaminants were detected above the groundwater surface and above a confining unit, the probability for rapid migration or surface exposure appears unlikely.

No surface water exists at Site No. 5, and there does not appear to be a potential connection between the site and adjacent surface waters. Groundwater concentrations of beryllium, cadmium, copper, lead, silver, and zinc were higher than surface water standards. However, no pathway for ecological exposure appears to exist, and the levels of the metals detected at Site No. 5 were similar to the concentrations in the background sample (09-MW-05).

5.9 SITE NO. 6--165TH VEHICLE MAINTENANCE SPILL AREA

5.9.1 Preliminary Human Health Evaluation

5.9.1.1 Selection of Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--four samples
- Groundwater--one sample

Table 5-9 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-9 are considered chemicals of concern, except dichloromethane (methylene chloride), which is a common laboratory contaminant. Table 5-10 summarizes the range of detected concentrations for each medium.

Table 5-9
Summary of Positive Detections
Site No. 6--165th Vehicle Maintenance Spill Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (μg/kg)				
Volatile Organic Compounds				
Dichloromethane	4/4	NA	2.4 - 2.7	NA
Toluene	1/4	1.2	1.3	NA
Priority Pollutant Metals				
Arsenic	4/4	NA	88 - 350	7,400
Beryllium	3/4	5.3	8 - 10	850
Cadmium	1/4	200 - 210	230	1,700
Chromium	4/4	NA	1,400 - 2,000	52,000
Copper	4/4	NA	1,300 - 2,200	22,000
Lead	4/4	NA	2,300 - 4,400	17,000
Mercury	4/4	NA	100 - 120	120
Nickel	4/4	NA	710 - 2,300	18,000
Selenium	1/4	130 - 140	210	450
Silver	1/4	820 - 890	830	2,800
Zinc	3/4	2,600	4,500 - 7,800	52,000
Groundwater (μg/l)				
Priority Pollutant Metals				
Cadmium	1/1	NA	4	<0.2
Chromium	1/1	NA	129	<2
Copper	1/1	NA	20	60
Lead	1/1	NA	64	22
Selenium	1/1	NA	232J	<25R
Zinc	1/1	NA	110	80

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984).

J = Concentration estimated because quality control criteria were not met or amount detected was below the detection limit.
NA = Not applicable
R = Quality control indicates data not usable.

Table 5-10
Range of Detected Concentrations
Site No. 6--165th Vehicle Maintenance Spill Area

Chemical	Concentration	
	Soil (µg/kg)	Groundwater (µg/l)
Volatile Organic Compounds		
Dichloromethane	2.4UJ - 2.7UJ	--
Toluene	1.3	--
Priority Pollutant Metals		
Arsenic	88 - 350	
Beryllium	8 -10	--
Cadmium	230	4
Chromium	1,400 - 2,000	129
Copper	1,300 - 2,200	20
Lead	2,300 - 4,400	64
Mercury	100 - 120	--
Nickel	710 - 2,300	--
Selenium	210	232J
Silver	830	--
Zinc	2,600 - 7,800	110

J = Concentration estimated because quality control criteria were not met or amount detected was below the detection limit.
µg\kg = micrograms per kilogram
µg\l = micrograms per liter
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
-- = Compound analyzed for but not detected.

5.9.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 6 are affected by several factors:

- The GANGB Master Plan indicates the base will remain in its current location through mid-year 2035. Access to the site is not restricted.

- The spill occurred in the early 1960s adjacent to a vehicle maintenance building, near the center of the Savannah International Airport, and migrated to a wooded area behind the facility.

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality. The water table is about 2 to 4 feet bls, flowing southeast toward a drainage ditch.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use. It has been reported that shallow wells have been installed within about 1 mile of the airport. The potentially affected groundwater may discharge to a drainageway.

The nature of the site activities and the contaminant behavior influenced the distribution VOCs and priority pollutant metals reported during the SI, and could influence future release and transport of these constituents.

Volatile Organic Compounds. VOCs typical of fuels are generally mobile in groundwater and tend to volatilize from surface soils and water. The depth to water in this area is less than 5 feet; therefore, a spill of fuels would be retained near the surface, which would facilitate losses from volatilization and biodegradation. The spill occurred approximately 30 years ago; therefore, significant attenuation would be expected.

Priority Pollutant Metals. Arsenic, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, and zinc were reported in soil and groundwater samples evaluated during the SI, and these detections may be attributed to naturally occurring levels. The soils samples contained these metals at concentrations typical of background levels.

Many metals are attenuated in groundwater from processes like cation exchange, sorption, and precipitation. Because particulates in groundwater samples may result in elevated concentrations of metals, detections are not necessarily representative of the mobility of these constituents. The elevated concentrations of metals detected in the groundwater samples are not characteristic of fuels, and other sources have not been identified. The concentrations of metals detected appear to be characteristic of basewide acidic conditions in the shallow aquifer.

5.9.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are in Appendix H. Lead is the only chemical of concern reported at Site No. 6 during the SI that is a known or suspected carcinogen by the ingestion pathway.

The groundwater samples (05-MW-01) had concentrations that exceeded the potential ARARs:

Chemical (µg/l)	Sample Concentration	MCL (µg/l) Final	MCL (µg/l) Proposed	EPA Region IV Guidance (µg/l)
Chromium	129	50	100	NA
Lead	64	50	5	15
Selenium	232J	10	50	NA

J = Concentration estimated because quality criteria were not met or amount detected was below detection limit
NA = Not applicable

5.9.1.4 Risk Screening

Soil. Trace concentrations of toluene were reported in one soil sample. Other fuel constituents were not reported, further suggesting that the toluene detection does not represent residual from the spill that occurred 30 years ago. The reported metals were typical of background concentrations, which does not suggest risks from direct contact exposures from ingestion. In addition, GANGB personnel would be expected to frequent this area. If this site were used for alternate base activities that could increase exposures, these activities would most likely not result in significant risk based on the available data.

Groundwater. No organic compounds were reported in the groundwater samples. In addition, shallow groundwater is not used for potable water supply. Total petroleum hydrocarbon levels suggested some residual hydrocarbons may be in the area.

Metal concentrations were elevated in the unfiltered groundwater samples. The selenium concentration (232 µg/l) detected in the groundwater sample exceeded the current and proposed MCLs, and this detection is not characteristic of the other groundwater samples collected during the SI. The lead concentration was above the current MCL and the current EPA Region IV guidance concentration of 15 µg/l. The concentration of chromium in the groundwater sample was also above the current and proposed MCLs. Sources of these metals have not been identified, but as with other

GANGB sites evaluated in the SI, their presence suggests that future potable use of the shallow aquifer would be limited.

5.9.2 PRELIMINARY ECOLOGICAL EVALUATION

No surface water exists at Site No. 6, and there appears to be a limited potential connection between the site and adjacent surface waters. Groundwater concentrations of copper and selenium were higher than surface water standards. Levels of these metals were higher than the concentrations detected in the background sample (09-MW-05); however, no pathway for ecological exposure appears to exist.

5.10 SITE NO. 7--165TH VEHICLE MAINTENANCE WASHRACK

5.10.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.10.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at one location
- Groundwater--samples from one monitor well
- Surface water--three samples from the drainageway
- Sediment--four samples from the drainageway

Table 5-11 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-11 are considered chemicals of concern, except dichloromethane, which is a common laboratory contaminant. Table 5-12 summarizes the range of detected concentrations for each medium. Metals were not analyzed at this site, and no contaminants were identified in the surface water samples.

5.10.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 7 are affected by several factors:

- The GANGB Master Plan indicates the base will remain in its current location through mid-year 2035. Access to the site is not restricted.

- The source area is currently under industrial use; the surrounding area consists of various base and airport facilities including the GANGB headquarter building.

Table 5-11
Summary of Positive Detections
Site No. 7--165th Vehicle Maintenance Washrack

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (μg/kg)				
Volatile Organic Compounds				
Toluene	1/2	1.2	2.8	NA
Groundwater(μg/l)				
Volatile Organic Compounds				
Dichloromethane	1/1	NA	1.3UJ	1U
Total Xylenes	1/1	NA	3.8	1U
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	1/1	NA	5	24
Sediment (μg/kg)				
Volatile Organic Compounds				
Dichloromethane	1/4	1.1 - 1.3	4.2	NA

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984).

J = Concentration estimated because quality control criteria were not met or amount detected was below detection.
μg/kg = micrograms per kilogram
μg/k = micrograms per liter
NA = Not applicable
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limits.

Table 5-12
Range of Detected Concentrations
Site No. 7--165th Vehicle Maintenance Washrack

Chemical	**Concentration**	
	Soil (µg/kg)	**Groundwater (µg/l)**
Volatile Organic Compounds		
Toluene	2.8	--
Total Xylenes	--	3.8
Polynuclear Aromatic Hydrocarbon Compounds		
Naphthalene	--	5.0

µg/kg = micrograms per kilogram
µg/l = microgram per liter
-- = Compound analyzed for but not detected

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality. Groundwater migrates to the east-southeast, toward the drainageway. The site is located about 1,000 feet from the GANGB boundary.

- Stormwater from the paved area is channeled or runs overland directly to the drainage ditch.

GANGB personnel could contact the sediments and surface water in the drainageway, although this contact would not be expected to be frequent. The shallow ditch would not be used for recreational purposes or fishing. Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use.

The nature of the site activities and the contaminant behavior influenced the distribution of the organic compounds reported during the SI, and could influence future release and transport of these constituents. Low levels of dichloromethane and toluene may represent laboratory contamination at this site. The remaining organic contaminants reported included detections of xylenes (3.8 μg/l) and naphthalene (5 μg/l) in the groundwater sample. These constituents are the lower mobility/volatility constituents associated with various fuels. The concentrations are substantially below saturation levels, suggesting the source may be dissolved fuel components released during the wash activities. However, significant soil contamination was detected in a soil boring that was abandoned.

Specific organic compounds were not identified in the sediment or surface water samples from the drainageway. The fuel components of potential concern do not appear to persist in that area, if routine releases have occurred.

5.10.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are in Appendix H. None of the chemicals of concern reported at this site are known or suspected carcinogens. The concentrations of chemicals of concern detected in the groundwater sample collected from this site did not exceed the potential ARARs.

5.10.1.4 Risk Screening

The laboratory analyses of the samples did not identify any organic constituents at concentrations above those observed in the soil, surface water, or sediment blank samples. Although the field screening suggested that some soils may be more highly contaminated, the groundwater sample did not contain concentrations that would indicate a large source of contamination.

Shallow groundwater is not used for potable water supply at this site. However, it is reported that shallow wells have been installed near the airport. In addition, the concentration of xylene detected (3.8 μg/l) was below the proposed MCL of 10,000 μg/l, and the concentration of naphthalene detected (5 μg/l) would not prohibit potable use of the aquifer based on its RfD of 0.004 mg/kg/day (2 l/day, 70 kg adult).

Current onsite exposures to soil, surface water, or sediment would be limited to infrequent contact by GANGB personnel. The data also suggest that if this area were used for other base activities with potential increased exposures, these activities would not result in significant risks.

5.10.2 PRELIMINARY ECOLOGICAL EVALUATION

No contaminants were detected in surface water samples collected at Site No. 7. Concentrations of organic contaminants detected in soil and groundwater samples were low compared to applicable surface water criteria, and the potential risk to biota appears low. However, significant soil contamination was detected during the field screening.

Although the presence of identifiable organic contamination was not made in the sediment samples collected from Site Number 8, TPH compounds were detected in each of the four samples collected. The concentrations of the four respective samples appears to indicate that the source of the contamination is the discharge point. The drainage ditch from which the sediment samples were collected travels off-site and eventually discharges into the Pipemaker's Canal. Even though TPH compounds were detected, their presence in the sediments appears relatively stable and of little threat as a source of long-term contamination. Additionally, the potential for exposure from contaminants within the sediment matrix is very limited considering the relative isolation and use of the drainage ditch.

5.11 SITE NO. 8--OLD 165TH AIRCRAFT WASHRACK

5.11.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.11.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at one location
- Groundwater--samples from four monitor wells
- Surface water--four samples from the drainageway
- Sediment--six samples from the drainage ditch

Table 5-13 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-13 are considered chemicals of concern, except dichloromethane, which is a common laboratory contaminant. Table 5-14 summarizes the range of detected concentrations for each medium.

5.11.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 8 are affected by several factors:

- The GANGB Master Plan indicates the base will remain in its current location through mid-year 2035. Access to the site is not restricted.

- The source area is currently under industrial use; the surrounding area is used for a variety of base and airport activities. The site is located at the east boundary of GANGB.

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality.

- The site was formerly used as a washrack, which included the use of solvents and paints. Paved areas drain to the southeast to a series of stormwater drains that connect to a drainage ditch, and water may run off the southern edge and percolate into the adjacent soils.

- The open drainage ditch receives surface water drainage from surrounding pavements and roadways and intercepts groundwater flow. The ditch ranges from 6 to 10 feet in width and 0.5 to 2 feet in depth. It eventually empties into Pipemakers Canal, about a mile from the site. Recreational or potable uses of surface water in the drainageways were not identified.

This site is not currently used for activities that are likely to result in high levels of exposure. If contaminants migrate offsite in the surface water, exposures to the public could result. However, the drainageways and Pipemakers Canal are not used for recreational or potable uses, and therefore, exposures to the public would likely be limited.

Shallow groundwater is not used for potable water supply at this site; however, the deeper aquifer is used for this purpose. It is reported that shallow wells have been installed near the base. Potential migration of contaminants to the lower aquifer or to offsite shallow groundwater could result in exposures to contaminants released from the site.

Table 5-13
Summary of Positive Detections
Site No. 8--Old 165th Aircraft Washrack

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (µg/kg)				
Volatile Organic Compounds				
1,1,1-Trichloroethane	1/6	1 - 1.3	1.2	NA
Trichloroethene	2/6	1.1 - 1.3	2.2 - 5.6	NA
1,1,2-Trichloroethane	1/6	1 - 1.3	1.4	NA
1,3-Dichlorobenzene	1/6	1 - 1.3	1J	NA
1,4-Dichlorobenzene	1/6	1 - 1.3	2.4	NA
1,2-Dichlorobenzene	1/6	1 - 1.3	2J	NA
Toluene	4/6	1 - 1.1	0.93J - 3.9	NA
Priority Pollutant Metals				
Chromium	4/6	2,600 - 3,000	4,700 - 8,800	52,000
Lead	4/6	2,600 - 3,000	2,600 - 19,000	17,000
Mercury	1/6	20	70	120
Nickel	2/6	2,600 - 3,200	2,600 - 3,200	18,000
Zinc	5/6	510	630 - 1,800	52,000
Groundwater (µg/l)				
Volatile Organic Compounds				
Dichloromethane	1/4	1 - 1000	1UJ	1U
Trichloroethene	1/4	1	69,000	1U
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	1/4	2	2	2U
Priority Pollutant Metals				
Arsenic	2/4	5	7 - 8	<5J
Beryllium	3/4	5	5 - 10	12
Cadmium	3/4	0.2	0.3 - 0.7	0.5
Chromium	4/4	NA	65 - 234	74

Table 5-13
Summary of Positive Detections
Site No. 8--Old 165th Aircraft Washrack

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Groundwater (µg/l) (cont)				
Priority Pollutant Metals				
Copper	4/4	NA	20 - 100	60
Lead	4/4	NA	97 - 133	22
Mercury	4/4	NA	0.5 - 1.4	0.3
Silver	1/4	10	10	11
Zinc	4/4	NA	30 - 90	80
Surface Water (µg/l)				
Volatile Organic Compounds				
Trichloroethene	1/4	1	4.4	NA
Priority Pollutant Metals				
Beryllium	2/4	5	100	NA
Cadmium	4/4	NA	0.5 - 1	NA
Chromium	4/4	NA	2J - 3J	NA
Copper	3/4	20	20	NA
Lead	4/4	NA	4J - 6J	NA
Zinc	4/4	NA	30 - 40	NA
Sediment (µg/kg)				
Volatile Organic Compounds				
Vinyl Chloride	1/6	1.2UJ - 1.3UJ	10.3J	NA
Dichloromethane	6/6		4.8UJ - 10.5UJ	NA
1,1-Dichloroethane	1/6	1.2 - 1.3	2.9J	NA
1,1,1-Trichloroethane	1/6	1.2 - 1.3	44.3J	NA
Trichloroethene	1/6	1.2 - 1.3	801*	NA
1,3-Dichlorobenzene	1/6	1.2 - 1.3	7.3	NA
1,4-Dichlorobenzene	1/6	1.2 - 1.3	15.6	NA
1,2-Dichlorobenzene	1/6	1.2 - 1.3	20.3	NA
Toluene	1/6	1.2 - 1.3	1.6J	NA

Table 5-13
Summary of Positive Detections
Site No. 8--Old 165th Aircraft Washrack

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Sediment (μg/l) (cont)				
Volatile Organic Compounds				
Total Xylenes	1/6	1.2 - 1.3	4.7	NA
Polynuclear Aromatic Hydrocarbon Compounds				
Phenanthrene	2/6	65 - 71	55 J - 3,200J	NA
Anthracene	1/6	63 - 71	780J	NA
Fluoranthene	3/6	65 - 68	72J - 2,900J	NA
Pyrene	2/6	65 - 71	51J - 2,800J	NA
Benzo(a) anthracene	1/6	63 - 71	1,100J	NA
Chrysene	1/6	63 - 71	1,600J	NA
Benzo(b) fluoranthene	1/6	63 - 70	730J	NA
Benzo(k) fluoranthene	1/6	63 - 71	480J	NA
Benzo(a) pyrene	1/6	63 - 71	930J	NA
Indeno(1,2,3-cd) pyrene	2/6	65 - 71	87J - 860J	NA
Priority Pollutent Metals				NA
Arsenic	6/6	NA	620J - 1,300J	7,400
Beryllium	3/6	600 - 640	620 - 780	850
Cadmium	6/6	NA	30 - 1,300	1,700
Chromium	6/6	NA	6,800 - 26,000	52,000
Copper	4/6	2,500 - 2,600	2,400 - 4,600	22,000
Lead	6/6	NA	16,700 - 25,700	17,000
Mercury	6/6	NA	40 - 460	120
Zinc	6/6	NA	5,200- 59,600	52,000

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984).

J = Concentration estimated because quality control criteria not met or amount detected was below detection limit.
NA = Not applicable
μg/kg = micrograms per kilogram
μg/l = micrograms per liter
U = Compound was analyzed for but not detected. Numerical value given is the estimated detection limit.
* = Sample result for this compound exceeded calibration range of instrument.

Table 5-14
Range of Detected Concentrations
Site No. 8--Old 165th Aircraft Washrack

Chemical	Concentration			
	Soil (µg/kg)	**Groundwater (µg/l)**	**Surface Water (µg/l)**	**Sediments (µg/kg)**
Volatile Organic Compounds				
Vinyl Chloride	--	--	--	10.3J
Dichloromethane	--	1UJ	--	4.8 - 10.5UJ
1,1-Dicholoroethane	--	--	--	2.9J
1,1,1-Trichloroethane	1.2	--	--	44.3J
Trichloroethene	2.2 - 5.6	69,000	4.4	801*
1,1,2-Trichloroethane	1.4	--	--	--
1,3-Dichlorobenzene	1J	--	--	7.3
1,4-Dichlorobenzene	2.4	--	--	15.6
1,2-Dichlorobenzene	2J	--	--	20.3
Toluene	0.93J - 3.9	--	--	1.6J
Total Xylenes	--	--	--	4.7
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	--	2	--	--
Phenanthrene	--	--	--	55J - 3,200J
Anthracene	--	--	--	780J
Fluoranthene	--	--	--	72J- 2,900J
Pyrene	--	--	--	51J - 2,800J
Benzo(a) anthracene	--	--	--	1,100J
Chrysene	--	--	--	1,600J
Benzo (b) fluoranthene	--	--	--	730J
Benzo(k) fluoranthene	--	--	--	480J
Benzo(a) pyrene	--	--	--	930J
Indeno(1,2,3-cd) pyrene	--	--	--	87J - 860J

Table 5-14
Range of Detected Concentrations
Site No. 8--Old 165th Aircraft Washrack

Chemical	**Concentration**			
	Soil (µg/kg)	**Groundwater (µg/l)**	**Surface Water (µg/l)**	**Sediments (µg/kg)**
Priority Pollutant Metals				
Arsenic	--	7.0 - 8.0	--	620 - 1,300
Beryllium	--	5.0 - 10	10	620 - 7,800
Cadmium	--	0.3 - 0.8	0.5 - 1.0	30 - 1,300
Chromium	4.7 - 8.8	65 - 234	2J - 3J	6,800 - 26,000
Copper	--	20 - 100	20	2,400 - 4,600
Lead	2.6 - 19.0	97 - 133	4J - 6J	16,700 -25,700
Mercury	0.07	0.5 - 1.4	--	40 - 460
Nickel	2.6 - 3.2	--	--	--
Silver	--	10	--	--
Zinc	0.63 - 1.8	30 - 90	30 - 40	5,200 - 59,600

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
U = Compound was analyzed for but not detected. Numerical value given is the estimated detection limit.
-- = Compound analyzed for but not detected
* = Sample result for this compound exceeded calibration range of instrument

The nature of the site activities and the contaminant behavior influenced the distribution of VOCs, PAH compounds, and priority pollutant metals reported during the SI, and could influence future release and transport of these constituents.

Volatile Organic Compounds. VOCs are generally mobile in groundwater and tend to volatilize from surface soils and water. Detectible concentrations of these constituents in all media sampled suggest that reasonably high concentrations of solvents were used and released at the site. The predominant VOCs at this site are the chlorinated solvents, rather than the aromatic constituents characteristic of fuels.

Because VOCs have a high volatility, intermedia transfers of these compounds may occur. This could result in releases from the source areas to the air, with potential exposures from inhalation. However, additional contributions from airport activities where fuels and solvents are commonly used may be the dominate source of VOCs in the air.

Solvents like trichloroethene would be expected to solubilize from sediments, and subsequently volatilize from surface water. These solvents would not be expected to persist in the surface water column or significantly bioconcentrate. These constituents were reported in surface water and sediment samples. The sediment samples appeared to contain a reasonably high level of solvents, which may be a continuing source to the surface water. However, these constituents would not be expected to persist in downstream locations because they would attenuate rapidly during transport.

The presence of trichloroethene in a groundwater sample (08-MW-01) at 69,000 µg/l suggests high concentrations of this solvent were released from the source. This concentration suggests a direct spill of the solvent may have occurred. The discharge of solvent to soils could have several consequences:

- Residual solvent providing a large continuing source of contamination.
- Density-driven vertical migration of solvents to the deeper aquifer resulting in a greater potential threat to the potable aquifer used in this area.

Anaerobic biodegradation products were not reported in the groundwater sample containing the high concentration of trichloroethene. This may indicate conditions in the groundwater were not sufficiently anaerobic for degradation to occur, or that the spill was relatively recent.

Higher concentrations of solvents in the soil were reported in the field screening than in the laboratory analyses. In two of the locations, higher concentrations were reported in the deeper samples. Solvents are attenuated more readily from surface soils as a result of volatilization, which would account for this pattern.

Polynuclear Aromatic Hydrocarbon Compounds. The concentrations of PAH compounds reported in soil, groundwater, and surface water samples do not suggest that substantial releases of fuels occurred at this site. Higher molecular weight PAH compounds were reported in the sediment samples. These constituents would accumulate and persist in this medium. These PAH compounds are likely the result of direct discharges of washwater and runoff to the drainageway.

Priority Pollutant Metals. Various metals were reported in each of the media evaluated during the SI, and some of these detections may be attributed to naturally occurring levels. Concentrations detected in soil samples were similar to typical background levels. Sediments frequently accumulate metals, perhaps because finer particles are transported to the drainageway during runoff events.

As with the samples from the other GANGB sites evaluated in the SI, metal concentrations in the unfiltered groundwater samples were elevated, and these concentrations may not be associated with onsite activities. Groundwater concentrations were generally higher than levels observed in surface water samples. The levels detected in the groundwater samples may be associated with particulates.

5.11.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and the toxicity profiles are in Appendix H. Several constituents reported at this site are known or suspected carcinogens by the ingestion pathway. These include several PAH *compounds*, trichloroethene, vinyl chloride, arsenic, beryllium, and lead. The following groundwater samples had concentrations that exceeded the potential ARARs:

Sample Location	Chemical	Sample Concentration (μg/l)	MCL (μg/l) Final	MCL (μg/l) Proposed	EPA Region IV Guidance (μg/l)
08-MW-01	Trichloroethene	69,000	5	NA	NA
08-MW-02	Beryllium	5	NA	1	NA
08-MW-03	Beryllium	8	NA	1	NA
08-MW-04	Beryllium	10	NA	1	NA
08-MW-01	Chromium	65	50	100	NA
08-MW-02	Chromium	83	50	100	NA
08-MW-03	Chromium	234	50	100	NA
08-MW-04	Chromium	170	50	100	NA
08-MW-01	Lead	108	50	5	15
08-MW-02	Lead	133	50	5	15
08-MW-03	Lead	135	50	5	15
08-MW-04	Lead	97	50	5	15

NA = Not applicable

Two surface water samples (08-SW-01 and 08-SW-02) had concentrations of beryllium (10 μg/l in each sample) that exceeded the FAWQC for the protection of humans from ingestion of fish (10^{-6} cancer risk of 0.12) and the chronic FAWQC for the protection of aquatic life (5.3 μg/l).

5.11.1.4 Risk Screening

Soil. Direct contact to soils by GANGB personnel is not expected to result in significant exposures because activities are limited at this site. Field screening results suggest soil concentrations are potential continuing sources of contamination to groundwater. Changes in the use of this area that may result in excavation or increased activity could potentially pose future risks to GANGB personnel from direct contact with solvents in the soil or their release to the air.

Groundwater. Although shallow groundwater is not currently used for potable water supply, the high concentrations of trichloroethene detected suggest a potential threat to offsite groundwater and to the lower aquifer, which is used for water supply. The extent of contamination was not fully defined during the SI. Therefore, although a current completed exposure pathway was not identified, data suggest potential future risks may occur and continued migration may spread the contamination unless it is determined that the contamination is confined.

Chromium and lead concentrations in the unfiltered groundwater samples exceeded the MCLs. Beryllium and arsenic concentrations exceed the 10^{-6} risk level for potable use of this water. The presence of these metals suggests that the shallow groundwater is unsuitable for potable use in this area, as was also observed in other areas evaluated at GANGB. However, a clear interpretation of these results is difficult because of the typically low mobility of these constituents, their association with particulates, the basewide distribution of metals, and the lack of a defined source.

Surface Water. The drainageways are not used for recreational or potable uses; therefore, potential threats to human health from exposure to this medium is limited. Trichloroethene was reported at a concentration (4.4 µg/l) below the FAWQC for protection of human health from the consumption of fish (80.7 µg/l). Of the several metals detected in the surface water samples, beryllium was the only metal reported above the FAWQC for protection of human health from the consumption of fish or the risk level for potable use of the water. Since a source of beryllium was not identified and the water in the drainageway is not used for fishing or potable water supply, no significant threat to human health is suggested based on the available data.

Sediment. Relatively high concentrations of solvents were identified in one of the sediment samples. These concentrations would not be expected to persist if external sources were removed. Upon release of the solvents to the surface water, volatilization would be expected to maintain the concentration in the water column below the FAWQC for protection of human health from the consumption of fish, and downstream concentrations would be expected to remain below detectable levels. These constituents do not significantly bioconcentrate in fish. Potential direct toxicity effects to aquatic organisms may occur.

PAH compounds accumulate and persist in sediments. However, direct human exposures to sediments at this site are not expected to be significant. Transfer to

aquatic organisms may occur, although these may be metabolized, reducing the potential fish tissue concentrations. Pore water in contact with these sediments may contain concentrations of PAH compounds above the FAWQC for protection of human health from the consumption of fish. However, fishing is not expected to occur in the drainageway, and these constituents are not expected to migrate significantly downstream.

Metals were reported in sediment samples at elevated concentrations and may contribute to the concentrations of beryllium that exceeded the FAWQC. Beryllium was not detected in the soil samples, and was at lower concentrations in the groundwater samples than those observed in the surface water samples. The high concentrations of this metal in the groundwater and sediment samples suggest a specific discharge to the drainageway may have occurred.

5.11.2 PRELIMINARY ECOLOGICAL EVALUATION

Beryllium, cadmium, copper, and lead exceeded water quality criteria in surface water samples collected at Site No. 8. In addition, trichloroethene, beryllium, cadmium, chromium, copper, lead, mercury, and zinc concentrations in groundwater were higher than the surface water limits. Potential risk to biota could occur through exposure to surface water in the drainage ditch at the site. However, because aquatic biota have not been surveyed at this site, the significance of this potential pathway could not be evaluated.

5.12 SITE NO. 9--CURRENT FIRE TRAINING AREA

5.12.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.12.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at four locations
- Groundwater--samples from five monitor wells
- Surface water--two samples from the drainageway
- Sediment--one sample from the drainage ditch

Table 5-15 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-15 were considered chemicals of concern, except dichloromethane, which is a common laboratory contaminant. Table 5-16 summarizes the range of detected concentrations for each medium.

Table 5-15
Summary of Positive Detections
Site No. 9--165th Current Fire Training Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (µg/kg)				
Volatile Organic Compounds				
Toluene	1/8	1 - 1.2	1	NA
Total Xylenes	1/8	1 - 1.2	3.9	NA
Priority Pollutant Metals				
Arsenic	6/8	250 - 300	400 - 4,000	7,400
Chromium	8/8	NA	2,500 - 16,300	52,000
Copper	3/8	1,100 - 1,200	1,800 - 2,500	22,000
Lead	8/8	NA	3,100 - 7,200	17,000
Mercury	4/8	20	20 - 30	120
Nickel	5/8	2,500 - 3,000	2,600 - 5,500	18,000
Zinc	8/8	NA	1,500 - 4,100	52,000
Groundwater (µg/l)				
Volatile Organic Compounds				
Tert-Butye Methyl Ether	2/5	1	1.1J- 2.3J	1UJ
Benzene	3/5	1	43J - 220*J	1U
Toluene	2/5	1	1J - 470*J	1U
Ethyl Benzene	2/5	1	14 - 6[illegible]	1U
Total Xylenes	3/5	1	5.5 - 500*	1U

Table 5-15
Summary of Positive Detections
Site No. 9--165th Current Fire Training Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Groundwater (µg/l)(cont.)				
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	2/5	2 - 50	4 - 12	2U
2-Methyl Naphthalene	3/5	2	5 - 130	2U
1-Methyl Naphthalene	3/5	2	6 - 118	2U
Priority Pollutant Metals				
Arsenic	1/5	5.0J	8J	<5J
Beryllium	3/5	5.0	7 - 15	12
Cadmium	3/5	0.2	0.2 - 1.3	0.5
Chromium	4/5		12J- 110	74
Copper	3/5	20	20 - 60	60
Lead	4/5		10 - 53	22
Mercury	2/5	0.2	0.3	0.3
Nickel	1/5	40	60	<40
Silver	2/5	10	10 - 15	11
Zinc	4/5		40 - 190	80
Surface Water (µg/L)				
Metals				
Arsenic	1/2	5	7	NA
Lead	1/2	2	3	NA

Table 5-15
Summary of Positive Detections
Site No. 9--165th Current Fire Training Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Sediment (µg/kg)				
Volatile Organic Compounds				
Dichloromethane	1/1	NA	5	NA
Priority Pollutant Metals				
Arsenic	1/1	NA	1,200	7,400
Chromium	1/1	NA	4,700	52,000
Lead	1/1	NA	24,000	17,000
Zinc	1/1	NA	5,600	52,000

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984)
J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
NA = Not applicable
U = Compound was analyzed for but not detected. Numerical value given is the estimated detection limit.
* = Sample result for this compound exceeded calibration range of instrument

Table 5-16
Range of Detected Concentrations
Site No. 9--165th Current Fire Training Area

Chemical	Concentration			
	Soil (µg/kg)	Groundwater (µg/l)	Surface Water (µg/l)	Sediment (µg/kg)
Volatile Organic Compounds				
Dichloromethane	-	--	--	5.0
Tert-Butyl Methylether	--	1.1J- 2.3J	--	--
Benzene	--	43J- 220*J	--	--
Toluene	1	1J- 470*J	--	--
Ethyl Benzene	--	14 - 67	--	--
Total Xylenes	3.9	5.5 - 500*	--	--
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	--	4 - 12	--	--
2-Methyl Naphthalene	--	5 - 130	--	--
1-Methyl Naphthalene	--	6 - 118	--	--
Priority Polluntant Metals				
Arsenic	400 - 4,000	8.0J	7	1,200
Beryllium	--	7.0 - 15	--	--
Cadmium	--	0.2 - 1.3	--	--
Chromium	2,500 - 16,300	12J- 110	--	4,700
Copper	1,800 - 2,500	20 - 60	--	--
Lead	3,100 - 7,200	10 - 53	3	24,000
Mercury	20 - 30	0.3	--	--
Nickel	2,600 - 5,500	60	--	--
Silver	--	10 - 15	--	--
Zinc	1,500 - 4,100	40 - 190	--	5,600

J = Concentration estimated because quality control criteria were not met or amount detected was less then detection limit.
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
-- = Compound was analyzed for but not detected.
* = Sample result for this compound exceeded calibration range of instrument.

5.12.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 9 are affected by several factors:

- The GANGB Master Plan indicates the base will remain in its current location through mid-year 2035. Access to the site is restricted.

- The site is near the southwest property boundary of the airport and is covered by maintained grass. The site is also near a perimeter taxiway and abandoned aircraft parking facilities.

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality. Groundwater migrates toward the pond.

- Stormwater runoff from the area may enter a swale, which discharges to Pipemakers Canal or to a stormwater retention pond. This includes runoff from the southeast quadrant of the airport property.

Although maintenance activities in the area may result in some exposure to contaminated surface soils, it is not anticipated that GANGB personnel would have frequent direct contact with surface soil, the stormwater retention pond, or drainage-way sediments. Discharges of contaminants to the drainageway may result in offsite transport to Pipemakers Canal. Although this surface water is not used for recreation or potable water supply, potential exposures to the public may occur from contact with the surface water or consumption of fish.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use.

The nature of the site activities and the contaminant behavior influenced the distribution of the organic compounds and priority pollutant metals reported during the SI, and could also influence future release and transport of these constituents.

Organic Compounds. The organic chemicals of concern identified in the laboratory analyses are aromatic constituents typical of fuels. The highest concentrations of organic compounds were reported in the groundwater samples, where these constituents would tend to persist. Organic compounds were reported in only low concentrations in surface soil samples, however, one soil boring was abandoned when significant fuel contamination was observed. Organic compounds were not reported in the surface water or sediment samples. Volatilization may have attenuated the organic compounds from these matrices.

Priority Pollutant Metals. Various metals were reported in each of the media evaluated during the SI, and some of these detections may be attributed to naturally occurring levels. The soil samples contained several metals at concentrations below typical background levels. Selenium was reported in one soil sample, with a concentration higher than the typical background level. In the sediment sample collected at the discharge point for the stormwater runoff to the ditch, lead was reported at a concentration of 24 mg/kg, which was somewhat above the typical background level of 17 mg/kg. As with samples collected from other areas of the base, elevated metal concentrations were reported in the unfiltered shallow groundwater samples. A point source discharge does not appear to be responsible for the elevated concentrations.

5.12.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for the chemicals of concern are summarized in Tables 5-1 and 5-2, and toxicity profiles are in Appendix H. Arsenic, beryllium, and benzene, which were detected during the SI at this site, are known or suspected carcinogens based on the ingestion pathway. The following groundwater samples had concentrations that exceeded the potential ARARs:

Sample Location	Chemical	Sample Concentration (μg/l)	MCL (μg/l) Final	MCL (μg/l) Proposed	EPA Region IV Guidance (μg/l)
09-MW-02	Benzene	220J	5	NA	NA
09-MW-03	Benzene	43J	5	NA	NA
09-MW-04	Benzene	64J	5	NA	NA
09-MW-02	Beryllium	10	NA	1	NA
09-MW-03	Beryllium	7	NA	1	NA
09-MW-04	Beryllium	15	NA	1	NA
09-MW-05	Beryllium	12	NA	1	NA
09-MW-02	Chromium	110	50	100	NA
09-MW-04	Chromium	98	50	100	NA
09-MW-05	Chromium	74	50	100	NA
09-MW-02	Lead	18	50	5	15
09-MW-03	Lead	53	50	5	15
09-MW-04	Lead	22	50	5	15
09-MW-05	Lead	22	50	5	15

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not applicable

Note: Monitor Well 09-MW-05 was a background well.

In one surface water sample (09-SW-02), arsenic was detected at 7 μg/l, which exceeded the FAWQC for the protection of human health from the consumption of fish (10^{-6} cancer risk of 0.0175).

5.12.1.4 Risk Screening

Soil. Organic constituents were detected at trace levels in surface soil samples; however, gross contamination was observed in one abandoned soil boring. Metal concentrations in the soil samples were below typical background concentrations, and these concentrations would not result in excessive risks, particularly under the limited exposures with the current land use. Samples examined during the field screening appeared to be more highly contaminated in the area of the oil-water separator, although laboratory analyses were not performed to allow an evaluation of the potential risks from the contamination at that location.

Groundwater. Samples from the upgradient monitor wells did not contain the organic compounds that were detected in the samples from the downgradient monitor wells. The organic constituents reported in the groundwater samples are common fuel constituents. Of the organic compounds for which current or proposed MCLs are available (benzene, toluene, ethylbenzene, and xylenes), only the benzene concentrations detected in samples from the three downgradient wells exceeded the drinking water standard. The MCLs were also exceeded for chromium and lead, and the 10^{-6} risk level for consumption of drinking water was exceeded for arsenic and beryllium. As with other sites, this may reflect basewide conditions.

Surface Water. Although specific organic constituents were not reported in the surface water samples, arsenic and lead were reported. Arsenic was above the FAWQC for protection of human health from consumption of fish in the sample collected at the runoff discharge point to the drainage ditch.

Sediment. Direct contact by GANGB personnel to sediments is not considered a likely exposure pathway. No organic constituents were identified in the sediment samples from the discharge point to the drainage ditch. Metal concentrations in the sediments may contribute to surface water concentrations; however, the sediment concentrations were generally below typical background concentrations.

5.12.2 PRELIMINARY ECOLOGICAL EVALUATION

Benzene, beryllium, cadmium, copper, lead, mercury, silver, and zinc concentrations in the groundwater samples were higher than the surface water limits. Although concentrations of beryllium, cadmium, copper, lead, mercury, silver, and zinc were detected at concentrations above surface water standards, it is probable that their detection in the groundwater is either due to natural occurrence or is particulate in nature. The groundwater sample collected from Site Number 10 was not filtered and therefore may represent particulate matter rather than dissolved metals. Additionally, the concentrations of metals detected in the sample collected from this site are in the

range of the concentrations of metals detected in the Base Background Well installed as part of the site investigation.

Potential risk to biota could occur through exposure to surface water in the drainage ditch at the site. However, because aquatic biota have not been surveyed at this site, the significance of this potential exposure pathway could not be evaluated.

5.13 SITE NO. 10--BULK CHEMICAL STORAGE AREA

5.13.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.13.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at one location
- Groundwater--sample from one monitor well

Table 5-17 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. No contaminants reported at the site were eliminated as potential chemicals of concern. Table 5-18 summarizes the range of detected concentrations for each medium.

5.13.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 10 are affected by several factors:

- The GANGB Master Plan indicates that the base will remain in its current location through mid-year 2035. Access to the site is restricted.

- The source area is currently under industrial use; the surrounding area consists of various base and airport activities.

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality.

Shallow groundwater is unlikely to be used for water supply at this site based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use. The potentially affected groundwater discharges to a nearby drainageway; therefore, the primary concern over contaminants in groundwater is the potential transport of contaminants and discharge to surface water.

Table 5-17
Summary of Positive Detections
Site No. 10--Bulk Chemical Storage Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soils (ug/kg)				
Volatile Organic Compounds				
1,1,1-Trichloroethane	1/2	1.3	1.5	NA
Trichloroethene	1/2	1.3	4.4	NA
Toluene	1/2	1.3	1.3	NA
Priority Pollutant Metals				
Chromium	2/2		7,000 - 15,300	52,000
Copper	1/2	1,100	2,000	22,000
Lead	2/2		4,700 - 7,000	17,000
Nickel	1/2	2,700	4,000	18,000
Zinc	2/2		1,300 - 3,700	52,000
Groundwater (ug/l)				
Volatile Organic Compounds				
1,1-Dichloroethene	1/1	NA	180*	1U
1,1-Dichloroethane	1/1	NA	37	1U
1,1,1-Trichloroethane	1/1	NA	430*	1U
Trichloroethene	1/1	NA	45	1U
Benzene	1/1	NA	1.2J	1U
Priority Pollutant Metals				
Beryllium	1/1	NA	6.0	12
Chromium	1/1	NA	64	74
Copper	1/1	NA	30	60
Lead	1/1	NA	48J	22
Mercury	1/1	NA	0.2J	11
Zinc	1/1	NA	40	80

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984)

J = Concentration estimated because quality control criteria not met or amount detected was below detection limit
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
NA = Not applicable
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
* = Sample result for this compound exceeded calibration range of instrument

Table 5-18
Range of Detected Concentrations
Site No. 10--Bulk Chemical Storage Area

Chemical	Concentration	
	Soil (μg/kg)	Groundwater (μg/l)
Volatile Organic Compounds		
1,1-Dichloroethene	--	180*
1,1-Dichloroethane	--	37
1,1,1-Trichloroethane	1.5	430*
Trichloroethene	4.4	45
Benzene	--	1.2J
Toluene	1.3	--
Priority Pollutant Metals		
Beryllium	--	6.0
Chromium	7,000 - 15,300	64
Copper	2,000	30
Lead	4,700 - 7,000	48J
Mercury	--	0.2J
Nickel	4,000	--
Zinc	1,300 - 3,700	40J

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
μg/kg = micrograms per kilogram
μg/l = micrograms per liter
* = Sample result for this compound exceeded calibration range of instrument
-- = Compound was analyzed for but not detected.

The nature of the site activities and the contaminant behavior influenced the distribution VOCs and priority pollutant metals reported during the SI, and could influence future release and transport of these constituents.

Volatile Organic Compounds. VOCs are generally mobile in groundwater and tend to volatilize from surface soils. According to the laboratory analyses, the surface soils at this site do not appear to have high concentrations of solvents. However, the field-screening results suggested higher concentrations may be present in the area. Elevated concentrations of chlorinated solvents and their associated degradation products were detected in groundwater samples, suggesting releases to groundwater have occurred. The deeper aquifer is used for potable water supply. Because chlorinated solvents have a high specific gravity, spills may vertically migrate in the groundwater. Therefore, the plume definition should include vertical as well as horizontal extent.

Characteristic anaerobic biodegradation products of trichloroethene and trichloroethane were not present; however, 1,1-dichloroethane is a chemical degradation product of trichloroethane. Trichloroethene and dichloroethene would be expected to be persistent.

Priority Pollutant Metals. Various metals were reported in each of the media evaluated during the SI, and some of these detections may be attributed to naturally occurring levels. The soil samples contained metals at concentrations below typical background levels.

As with samples collected from other sites at the base, the shallow groundwater samples contained elevated concentrations of various metals that do not appear to be related to specific activities at the source areas. Particulates in groundwater samples may have contributed to the elevated concentrations of these metals in the samples, and therefore the concentration detected may be more representative of the basewide levels characteristic of acidic shallow groundwater than of the mobility of the metals.

5.13.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for chemicals of concern are summarized in Tables 5-1 and 5-2, and the toxicity profiles are in Appendix H.

The groundwater sample from Monitor Well 10-MW-01 had the following concentrations that exceeded the potential ARARs:

Chemical	Sample Concentration (μg/l)	MCL (μg/l) Final	Proposed	EPA Region IV Guidance (μg/l)
1,1-dichloroethene	180	7	NA	NA
1,1,1-trichloroethane	430	200	NA	NA
Trichloroethene	45	5	NA	NA
Beryllium	6	NA	1	NA
Chromium	64	50	100	NA
Lead	48	50	5	15

5.13.1.4 Risk Screening

Soil. The data collected from the laboratory analyses suggest the solvent concentrations are low; however, these concentrations may reflect the sampling location. Limited exposure to surface soils by GANGB personnel under the current land use reduces the potential risks.

Groundwater. Shallow groundwater is not used in this area for potable water supply; however, the aquifer could potentially be used for that in the future. The concentrations of 1,1-dichloroethene, 1,1,1,-trichloroethane, and trichloroethene detected in the groundwater sample were above current or proposed MCLs. Although no current completed exposure pathway was identified, potential risks may occur if these contaminants migrate offsite or to the deeper aquifer. Additional information on the vertical and horizontal extent of the contamination is required to determine if additional action is required.

As with samples collected from the others sites, metal concentrations in the unfiltered groundwater sample were elevated. The chromium concentration was above the current MCL, and the lead concentration was near the MCL but above the current EPA Region IV guidance concentration of 15 μg/l. Beryllium was above the 10^{-6} risk level for potable use. These metals are not likely to be mobile, and their detections may be associated with particulates. The presence of metals in the groundwater sample appears to represent basewide conditions.

5.13.2 PRELIMINARY ECOLOGICAL EVALUATION

No surface water exists at Site No. 10, and there does not appear to be a significant connection between the site and adjacent surface waters. Groundwater concentrations of 1,1-dichloroethene, 1,1,1-trichloroethane, beryllium, copper, and lead were higher than surface water standards. However, the potential for exposure to biota appears low because the site is highly developed and the site is not connected to surface water.

5.14 SITE NO. 11--OLD BURN AREA

5.14.1 PRELIMINARY HUMAN HEALTH EVALUATION

5.14.1.1 Chemicals of Concern

Field sample data for the following media were collected and analyzed:

- Soil--samples from two depths at two locations
- Groundwater--samples from four monitor wells

Table 5-19 is a summary of the positive detections for each medium. The table lists the frequency of detection, the range of quantitation limits, the range of detected concentrations, and the background levels. All of the chemicals shown in Table 5-19 were considered potential chemicals of concern, except dichloromethane, which is a common laboratory contaminant. Table 5-20 summarizes the range of detected concentrations for each medium.

5.14.1.2 Exposure Pathway Assessment

The exposure to contaminants associated with activities at Site No. 11 are affected by several factors:

- The site is abandoned and currently owned by Gulfstream Aerospace Corporation. Access to the site is restricted.

- The site is located in the northernmost section of the Savannah International Airport.

- The source area is currently undeveloped. The surrounding area consists of various airport facilities, the Gulfstream Aerospace manufacturing facility, and undeveloped land.

- Shallow groundwater is not used for potable water supply at this site, although the water is potentially of potable water quality. Groundwater migrates toward the northwest.

Shallow groundwater is unlikely to be used for water supply based on the availability of an alternate source of better yield and water quality, but potable use may be considered a potential future use.

The nature of the site activities and the contaminant behavior influenced the distribution of the organic compounds and priority pollutant metals reported during the SI, and could influence future release and transport of these constituents.

Table 5-19
Summary of Positive Detections
Site No. 11--Old Burn Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Soil (μg/kg)				
Volatile Organic Compounds				
Toluene	1/4	1.0 - 1.2	1.1	NA
Polynuclear Aromatic Hydrocarbons				
Naphthalene	1/4	51 - 1000	110	NA
2-Methyl Naphthalene	1/4	51 - 530	110	NA
1-Methyl Naphthalene	1/4	51 - 530	80	NA
Priority Pollutant Metals				
Chromium	3/4	2,600	4,000 - 11,700	52,000
Copper	1/4	1,000 - 1,200	1,800 - 8,400	22,000
Lead	2/4	2,500	6,200 - 14,700	17,000
Mercury	1/4	20	70	120
Nickel	2/4	2,600 - 3,100	4,000 - 6,200	18,000
Zinc	4/4		620 - 3,100	52,000
Groundwater (μg/l)				
Volatile Organic Compounds				
Dichloromethane	1/4	1	8.8	1U
Benzene	1/4	1	36J	1U
Toluene	1/4	1	39J	1U
Total Xylenes	1/4	1	170*	1U

Table 5-19
Summary of Positive Detections
Site No. 11--Old Burn Area

Chemical	Frequency of Detection	Range of Sample Quantitation Limits	Range of Detected Concentrations	Background Level[a]
Polynuclear Aromatic Hydrocarbon Compounds				
Naphthalene	1/4	2	3	2U
2-Methyl Naphthalene	1/4	2	3	2U
1-Methyl Naphthalene	1/4	2	5	2U
Priority Pollutant Metals				
Beryllium	2/4	5	5 - 6	12
Cadmium	1/4	0.2	0.4	0.5
Chromium	4/4	NA	8 - 128	74
Copper	3/4	20	60 - 90	60
Lead	4/4	NA	7J - 112J	22
Mercury	1/4	0.2	0.9	0.3
Nickel	2/4	40	80 - 90	<40
Silver	3/4	10	10J- 13J	11
Zinc	3/3	NA	70J- 90J	80

[a]Background values for inorganic chemicals were taken from the U.S. Geological Survey (1984)

J = Concentration estimated because quality control criteria were not met or amount detected was less than detection limit.
µg/kg = micrograms per kilogram
µg/l = micrograms per liter
ND = Not detected
NA = Not applicable
U = Compound was analyzed for but not detected. Numerical value is the estimated detection limit.
* = Sample result for this compound exceeding calibration range of instrument

Table 5-20
Range of Detected Concentrations
Site No. 11--Old Burn Area

Chemical	Concentration	
	Soil (μg/kg)	Groundwater (μg/l)
Volatile Organic Compounds		
Benzene	--	36J
Toluene	1.1	39J
Total Xylenes	--	170*
Polynuclear Aromatic Hydrocarbons		
Naphthalene	110	3
2-Methyl Naphthalene	110	3
1-Methyl Naphthalene	80	5
Priority Pollutant Metals		
Beryllium	--	5 - 6
Cadmium	--	0.4
Chromium	4,000 - 11,700	8 - 128
Copper	1,800 - 8,400	60 - 90
Lead	6,200 - 14,700	7J - 112J
Mercury	70	0.9
Nickel	4,000 - 6,200	80 - 90
Silver	--	10J - 13J
Zinc	620 - 3,100	70J - 90J

* = Sample result for this compound exceeded calibration range of instrument.

Organic Compounds. The organic chemicals of concern reported at Site No. 11 consisted of several aromatic compounds typical of fuels: benzene, toluene, xylenes, naphthalene, 1- and 2-methylnaphthalenes. These chemicals were reported in one of the four soil samples and the groundwater samples that were collected from the monitor well near the edge of the burn area. Concentrations of organic compounds were below detection limits in the groundwater samples collected from the wells located 200-300 feet downgradient. The reported concentrations of organic compounds were at levels that suggested there is no large source of residual fuel in the soil in this area. The shallow depth to the water table (7-10 feet bls) can promote attenuation of these constituents by volatilization and diffusion through the vadose zone. The groundwater flow rate is estimated to be 0.11 feet/day, suggesting that contaminants released in this area could potentially have migrated to the downgradient wells if the releases occurred over the last few years.

Priority Pollutant Metals. Elevated concentrations of several metals were reported in the shallow groundwater samples. These concentrations appeared to be consistent with levels reported in other areas of the base, and may be attributed to the acidic conditions of the groundwater. Metals may be released from the soils and be somewhat mobile; however, these metals would be attenuated upon migration to a more buffered groundwater zone.

5.14.1.3 Toxicity Assessment

The critical toxicity values (slope factors and RfDs) for chemicals of concern are summarized in Tables 5-1 and 5-2, and the toxicity profiles are in Appendix H.

The following groundwater samples had concentrations that exceeded the potential ARARs:

Sample Location	Chemical	Sample Concentration (µg/l)	MCL (µg/l) Final	MCL (µg/l) Proposed	EPA Region IV Guidance (µg/l)
11-MW-02	Benzene	36J	5	NA	NA
11-MW-03	Beryllium	6	NA	1	NA
11-MW-04	Beryllium	5	NA	1	NA
11-MW-02	Chromium	99	50	100	NA
11-MW-03	Chromium	101	50	100	NA
11-MW-04	Chromium	128	50	100	NA
11-MW-05	Lead	112	50	5	15
11-MW-02	Lead	61	50	5	15
11-MW-04	Lead	80	50	5	15

J = Concentration estimated because quality control criteria were not met or amount detected was below detection limit.
NA = Not applicable

5.14.1.4 Risk Screening

Soil. Toluene was reported near the detection limit in one surficial soil sample. This constituent would not be expected to persist, and its presence may be influenced by ambient air concentrations. Naphthalene was reported in a subsurface soil sample; however, the concentration detected would not result in excessive risk from direct contact exposures and would not restrict future use of this area. Naphthalene was also reported in subsurface soil samples; however, there would be no direct contact exposure if these soils remain in place. The presence of naphthalene may contribute to the concentration observed in the groundwater sample, which did not exceed acceptable risk levels based on potable use.

Groundwater. The shallow groundwater at the base is not used for potable water supply. The contaminants do not appear to be migrating offsite, and may be attenuating near the source area by volatilization and biodegradation. Benzene was reported at 36 μg/l in the groundwater sample collected near the potential source of contamination. This concentration is above the MCL of 5 μg/l. Toluene, xylene and naphthalene were detected at concentrations that did not exceed the levels considered protective for domestic use of the groundwater.

Chromium and lead concentrations exceeded drinking water standards. In addition, beryllium was present at levels that exceeded the 10^{-6} risk level for potable use of groundwater. These concentrations appear to reflect the basewide conditions for these constituents, which suggests the shallow groundwater in this area exceeds acceptable risk levels for potable use.

5.14.2 PRELIMINARY ECOLOGICAL EVALUATION

No surface water exists at Site No. 11, and there does not appear to be a potential connection between the site and adjacent surface waters. Beryllium, chromium, copper, lead, mercury, nickel, silver, and zinc concentrations in groundwater were higher than surface water limits. However, no pathway for ecological exposure appears to exist, and the levels of several of the metals at Site No. 11 were similar to concentrations in the background sample collected from Monitor Well 09-MW-05.

Chapter 6
CONCLUSIONS AND RECOMMENDATIONS

A decision regarding future actions at each of the nine sites will be made based on the results of the SI at GANGB. This decision may include preparing a decision document (DD), performing a focused feasibility study (FFS), performing additional SI work or performing a remedial investigation (RI). The decision could be made for each operable unit or an entire site. The following sections describe recommendations for these future activities based on the results of this SI.

6.1 SITE NO. 1--CRTC HANGER AND WASHRACK DISCHARGE POINT

The results of the SI performed at Site No. 1 indicated that the groundwater and surface water did not contain organic contamination. Toluene was detected at a low concentration in one soil sample. The analytical results of sediments in the discharge ditch indicated the presence of PAH compounds. The source of these compounds may be activities performed at the washrack; however, road runoff may be a contributing factor. Except for the point of discharge (01-SS-12), PAH concentrations were highest near the intersections of the two roads. Although PAH contamination was not detected in some sediment samples downstream from the discharge point, detections in samples 01-SS-10 and 01-SS-09 may indicate that some contaminant migration has occurred in the downstream reaches. The presence of PAH compounds in sample 01-SS-01 is likely due to higher rates of contaminant settling, since water in the area is quite stagnant. The preliminary risk evaluation indicated that potential exposure to these chemicals is low.

Priority pollutant metals detected in the soil and sediment were typical for the type of soil in this area. In the groundwater and surface water, metals were below the MCLs. Lead was above the EPA Region IV guidance concentration of 15 µg/l in unfiltered groundwater samples, but was below detection limits for filtered samples. The presence of metals in the water samples is likely due to low pH conditions that increase the mobility of metals and the natural metal content of soils in this area.

Based on the analytical results, visual observations, and a preliminary evaluation of the risks from Site No. 1, it is recommended that additional sediment samples be collected in background areas to assess typical PAH concentrations that may be associated with urban areas. If background PAH concentrations in sediments are similar to those at Site No. 1, a DD may be drafted removing the groundwater, surface water, soil, and sediment from the IRP. If sediment appears to be affected by

conditions at Site No. 1, additional RI work may be required for Site No. 1 sediments. A DD may still be appropriate for groundwater, surface water, and soil. This conclusion is based on the results of samples taken at the time of this SI. Activities conducted at Site No. 1 and the hangar since the SI could affect the condition of each environmental medium.

6.2 SITE NO. 2--CRTC VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT

Laboratory analyses indicated that the upper soil sample contained PAH compounds and TPH but not VOCs. This may indicate a discharge from the site. Because these compounds were not found in the deeper soil sample, it appears that the source of contamination has not migrated significantly. The preliminary risk evaluation indicated that the potential for exposure to these chemicals is low.

The analyses of the groundwater and surface water samples collected at Site No. 2 did not detect VOCs or PAH compounds. Analytical results of sediments underlying the drainage ditch showed PAH compounds and TPH at elevated levels. The concentrations decreased with distance from the point of discharge, suggesting a direct discharge from Site No. 2. The preliminary risk evaluation, however, indicated that potential exposure to these type of chemicals at this site are low.

Based on the analytical results, visual observations, and a preliminary evaluation of the risks from Site No. 2, it is recommended that a DD be drafted removing the groundwater from the IRP. Additional confirmation sampling should be conducted for sediments and surface water which includes samples upstream of the discharge point. The upgradient samples will help evaluate if runoff from Dean Forest Road contributes to the PAH and TPH values observed at the discharge point. In addition, the affected soils may be removed. This may be preceded by additional SI work to identify the approximate volume of affected soil. This conclusion is based on the results of samples taken at the time of this SI. Activities conducted at Site No. 2 including the operation of the oil-water separator following the SI could affect the condition of each environmental medium.

6.3 SITE NO. 5--165TH BULK FUEL FACILITY

The results of the SI performed at Site No. 5 indicated that soil contamination exists along the northeast side of the site. There was contamination observed along the railroad track and the ditch extending to the east in an area where a spill has been documented. Along this corridor, PAH compounds were detected in concentrations up to 2,000 µg/kg. The extent of the contamination was not evaluated since the spill

migrated offsite. Because of this likelihood of offsite migration to adjacent properties, it is recommended that an access agreement with the adjacent property owner such that the contaminated soil can be removed. Confirmatory samples should be collected during this removal action. Prior to the soil removal, additional SI work should be performed to estimate the volume of affected soil.

Analyses of groundwater samples collected at Site No. 5 detected contamination in excess of the MCL for benzene in the existing well near a buried heating-oil tank. During the SI at Site No. 5, offsite access was not obtained. This prevented the installation of a well in the area where the fuel spill was reported to have accumulated. It is recommended, therefore, that an RI be performed at Site No. 5 to investigate the groundwater quality downgradient of the site, to define the extent of contamination around the buried tank, and to investigate potential contamination in offsite areas. This will likely involve the installation of two to three monitor wells off the property north of the railroad tracks where spilled fuel was collected.

6.4 SITE NO. 6--165TH VEHICLE MAINTENANCE SPILL AREA

Laboratory analyses performed on soil samples collected from hand-auger borings identified only one positive detection (1.3 μg/kg toluene). It appears, therefore, that no residual contamination remains in the soils at Site No. 6 from the reported fuel spill. The presence of toluene in the one sample may be attributed to background levels, which could result from aircraft exhaust or other airborne sources.

One monitor well was installed at Site No. 6. Laboratory analyses of the water sample collected from this well detected TPH at a concentration slightly above detection levels (0.09 mg/l). VOC and PAH compounds were below detection levels.

Priority pollutant metals detected in the soil were typical for the type of soil in this area. In the groundwater, metals were detected above the MCLs; however, the analytical results for the filtered lead sample suggested that metals may be associated with particulate matter in the samples. The preliminary risk evaluation indicated that the presence of metals in the water samples is also likely due to low pH conditions that increase the mobility of metals.

On the basis of the SI results, it appears that natural processes have degraded the remaining fuel that was spilled at this site. Therefore, it is recommended that a DD be written for the soil and groundwater at Site No. 6.

6.5 SITE NO. 7--165TH VEHICLE MAINTENANCE WASHRACK

Field activities at Site No. 7 indicated the presence of soil and groundwater contamination. During the installation of Soil Boring 07-SB-01, located approximately 10 feet north of the oil-water separator, petroleum based contaminated soils were visually observed in combination with elevated field photo-ionization detector (PID) readings and the soil boring was abandoned. Laboratory analyses of soil samples collected from a second boring located approximately 50 feet farther north detected low levels of toluene and TPH.

A monitor well was installed at Site No. 7 between the two soil borings, downgradient of the oil-water separator. Analyses of the groundwater sample from this well detected low levels of VOCs and PAH compounds. The level of these compounds was below applicable standards but above background levels suggesting a discharge from the site.

Laboratory analyses of the surface water samples collected from the discharge ditch did not report contamination above detection levels. Surface water quality at this site, however, could vary frequently depending upon activities at Site No. 7, including discharges from the oil-water separator.

Sediment samples collected from the ditch contained TPH in concentrations ranging from 3.4 to 658 mg/kg; however, TPH is not regulated with an applicable standard. TPH concentrations decreased with distance from the discharge point indicating a discharge from the site. The presence of TPH at this site may indicate a direct impact of site activities on sediments.

Based on the observation of soil contamination a removal action should be conducted at this site to dispose of contaminated soils. Additional SI work should be performed to estimate the amount of affected soil. Confirmatory soil samples should be collected to verify the success of the removal action. A confirmatory groundwater sample should be collected to verify the results obtained during this SI. The results of the SI did not identify specific surface water or sediment contaminants. Additional SI work could be performed to collect background samples for comparison with the results at Site No. 7. A DD could be prepared for the surface water and sediment if background readings are similar to results from Site No. 7. Active steps should be taken so that site activities do not affect surface water and sediments in the future.

6.6 SITE NO. 8--OLD 165TH AIRCRAFT WASHRACK

The SI performed at Site No. 8 indicated several areas with elevated levels of contamination. Laboratory analyses of samples from each of the three soil borings detected levels of VOCs and TPH.

The groundwater sample from Monitor Well 08-MW-01 contained 69,000 µg/l of trichloroethene (69,000 µg/l) plus other VOCs. The MCL for trichloroethene is 5 µg/l. According to the preliminary risk evaluation, this concentration represents a level that would likely migrate vertically.

Laboratory analyses of the surface water samples collected from the ditch at Site No. 8 detected 4.4 µg/l trichloroethene at the discharge point. Sediment samples collected at the point of discharge contained elevated levels of VOCs and PAH compounds. These sediments could release additional contaminants to surface waters.

Based on the levels of contamination observed in the groundwater, surface water, soil, and ditch sediment samples, it is recommended that an RI be performed to assess the lateral and vertical extent of contamination at Site No. 8.

6.7 SITE NO. 9--165TH CURRENT FIRE TRAINING AREA

Field activities performed at Site No. 9 indicated the presence of soil and groundwater contamination. Field screening of Soil Boring 09-SB-04, located north of the oil-water separator, detected petroleum based contamination, and the boring was abandoned. Groundwater contamination was detected in samples from three wells installed at Site No. 9. Samples from Monitor Wells 09-MW-02, 09-MW-03, and 09-MW-04 contained VOCs such as benzene in excess of applicable standards, in addition to PAH compounds and TPH. This groundwater contamination may be the result of leaks from the oil-water separator or breaches in the liner underlying the burn area.

VOC and PAH contamination was not detected in sediment samples collected in the drainage ditch; however, the proximity of the drainage ditch to the observed soil contamination could alter these results based on use of the Fire Training Area or under certain weather conditions. The surface water sample collected in the drainage ditch did not contain contamination, but the surface water condition, like the sediment condition, may change quickly.

Based on the delineation of soil contamination in the vicinity of soil boring 09-SB-04, a removal action should be pursued with confirmatory sampling conducted during the removal. Hand augered samples should be conducted within the FTA (previously not

investigated) to check for contamination during additional SI work. Based on the detection of petroleum contamination in the groundwater, in excess of MCLs, an RI/FS should be conducted. This will include a downgradient well from 09-MW-03, and samples from the drainage ditch and Pipemakers Canal. An additional round of groundwater sampling should also be included.

6.8 SITE NO. 10--BULK CHEMICAL STORAGE AREA

Soil contamination was detected at Site No. 10, confirming a release from the site. VOC contamination was detected in groundwater downgradient of the site in excess of applicable standards and MCLs. These compounds are indicative of the chemicals reportedly stored at this facility which appeared to have migrated downgradient.

The areal extent of soil contamination was not defined; however, the SI did not detect contamination at 10 feet in the soil boring. Because the former drum storage area is small, a removal action could be implemented immediately by excavating the surface soils and disposing them at a licensed hazardous waste disposal facility. If the extent of soil contamination is below the paved areas, additional investigation may be required. This is unlikely, however, since the pavement would inhibit contaminant migration.

The extent of groundwater contamination was not defined during the SI, therefore, an RI of the groundwater should be performed at Site No. 10. This should include an upgradient monitor well cluster near piezometer 10-PZ-03.

6.9 SITE NO. 11--OLD BURN AREA

Site No. 11 poses several challenges in recommending future courses of action. The SI identified soil and groundwater contamination in the vicinity of the burn pit. Soil borings were installed within the burn pit and downgradient from the pit. Field screening of soil samples collected from Soil Boring 11-SB-01, located within the burn pit, detected contamination, and laboratory analyses of samples from this boring detected PAH compounds and TPH. Laboratory analyses of samples from Soil Boring 11-SB-02 also detected low levels of VOCs and TPH.

Three monitor wells were installed at Site No. 11; one well (11-MW-01) was installed on the edge of the burn pit and two wells were installed approximately 100 yards downgradient from the burn pit. Laboratory analyses of a groundwater sample collected from Monitor Well 11-MW-01 detected elevated levels of VOCs in excess of applicable standards for benzene. PAH compounds were also detected, indicating a

discharge. Samples from the wells installed downgradient of the burn pit did not contain contamination above detection limits.

As pointed out in the preliminary risk evaluation, the results suggest that contamination has not migrated downgradient from the source even though this site is in an area of steep groundwater gradient. This site has been abandoned for a number of years, and the potential for further downgradient migration appears low. However, a potential offsite receptor, Gulfstream Aerospace, is downgradient of this site.

A DD could be pursued based on the apparent lack of downgradient migration. An RI, however, could also be justified based on the offsite property owner and the detection of benzene above MCL. The compromise recommendation is a resampling of the existing monitor wells to confirm the results presented in this SI before preparing a DD. This resampling could be considered a limited or focused RI. A removal action should be pursued for soil in the vicinity of soil boring 11-SB-01 followed by confirmatory sampling. Additional SI work should be performed prior to soil removal to estimate the quantities of affected soil.

6.10 SUMMARY

Based on the results of the SI, it is recommended that DDs be prepared for Site No. 1 (groundwater, soil and surface water), Site No. 2 (groundwater), Site No. 6, and Site No. 7 (surface water). A DD may be appropriate for sediments at Site No. 1, Site No. 2, and Site No. 7 based on the results of background sediment samples collected during an SI addendum. A removal action should be pursued for contaminated soil at Site No. 2, Site No. 5, Site No. 7, Site No. 9, and Site No. 11. Additional SI work should be performed to estimate the amount of affected soil. Additional information in the form of an RI is needed for Site No. 5 (groundwater), Site No. 8 (all medium), Site No. 9 (groundwater, surface water, and sediments), and Site No. 10 (soil and groundwater). Confirmatory sampling should be conducted during removal actions and for Site No. 2 (sediment, surface water and soil), Site No. 7 (groundwater and sediments), and Site No. 11 (groundwater) Table 6-1 is a summary of the recommended actions.

TABLE 6-1
SUMMARY OF RECOMMENDED ACTIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

	SOIL				SEDIMENT				GROUNDWATER				SURFACE WATER			
SITE	DD	REMOVAL	CONF. SAMPLING	RI/FS	DD	REMOVAL	CONF. SAMPLING	RI/FS	DD	REMOVAL	CONF. SAMPLING	RI/FS	DD	REMOVAL	CONF. SAMPLING	RI/FS
SITE NO. 1	X						X		X				X			
SITE NO. 2		X					X		X						X	
SITE NO. 5		X										X				
SITE NO. 6	X								X							
SITE NO. 7		X					X				X				X	
SITE NO. 8				X				X				X				X
SITE NO. 9		X						X				X				X
SITE NO. 10				X								X				
SITE NO. 11		X									X					

DD = Decision Document
FFS = Focused Feasibility Study
RI = Remedial Investigation
X = Recommended Site Action
NOTE: Confirmatory Sampling may include additional background or upgradient sampling

Section 7
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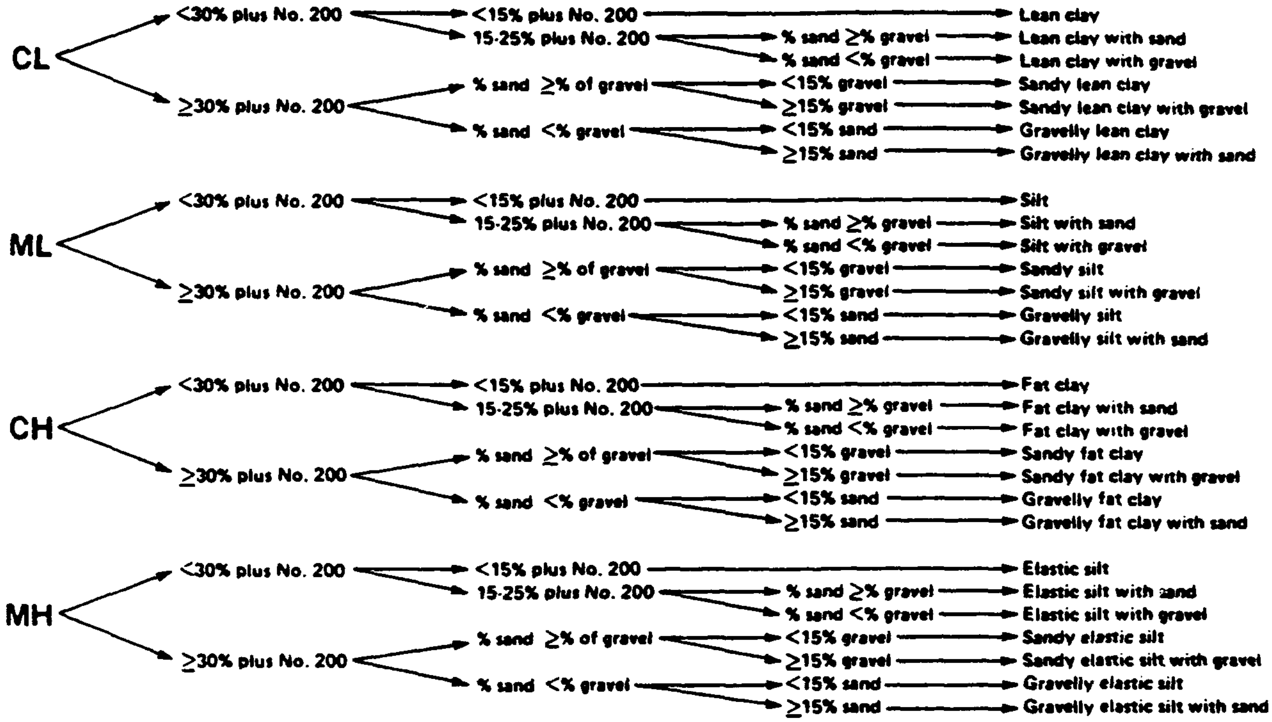
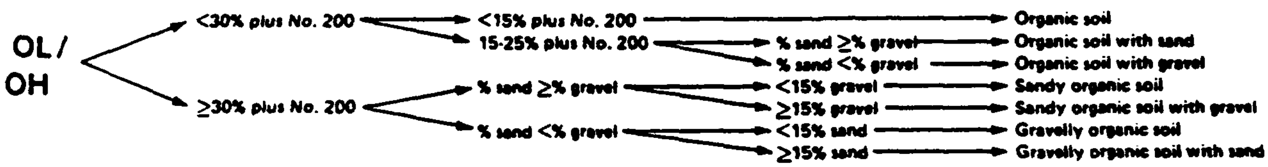
Hand Auger Sample Logs

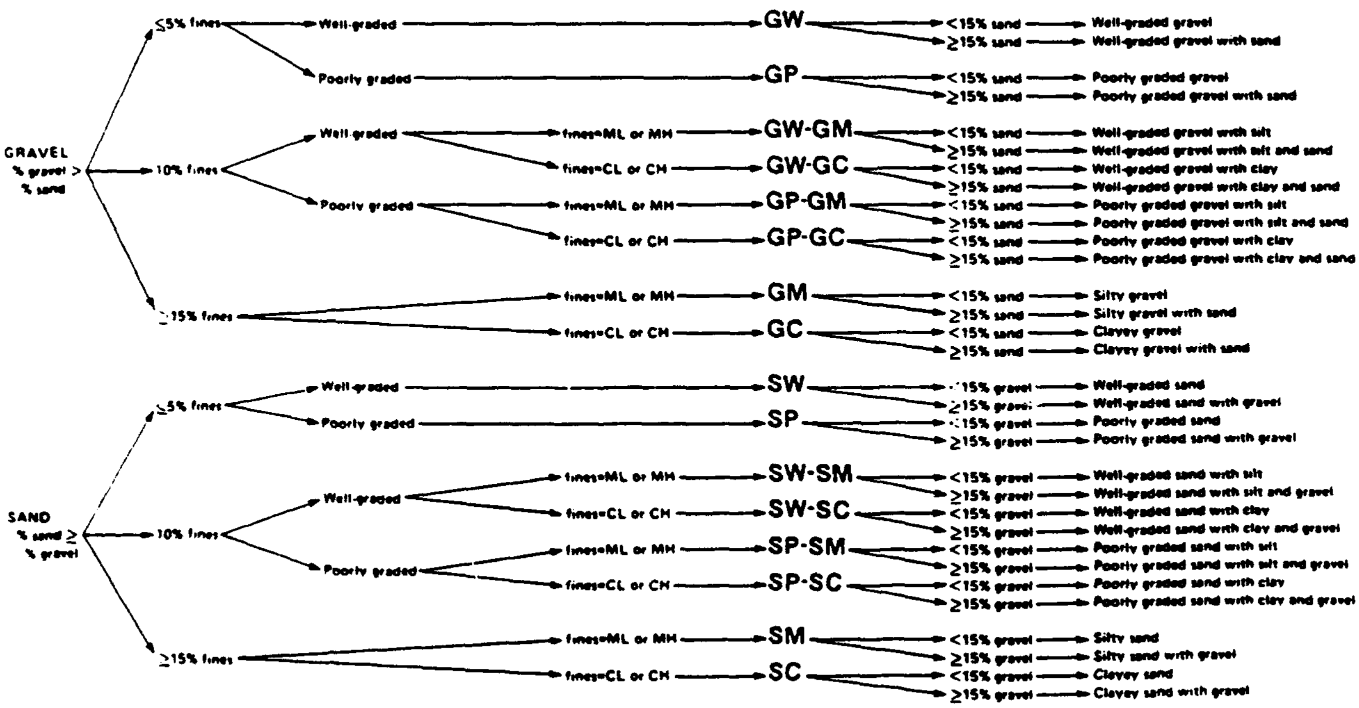
FLOW CHART FOR IDENTIFYING INORGANIC FINE–GRAINED SOIL (50% OR MORE FINES)



FLOW CHART FOR IDENTIFYING ORGANIC FINE–GRAINED SOIL (50% OR MORE FINES)



FLOW CHART FOR IDENTIFYING COARSE–GRAINED SOILS (LESS THAN 50% FINES)



NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FLOW CHARTS FOR CLASSIFICATION OF FINE–GRAINED AND COARSE–GRAINED SOILS

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 10:30 am Hand Auger Boring No. 05-HA-01
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 5 mph , Precipitation 0" Last 24 hr , Air Temperature 72°
6. Sample Identification No. 05-HA-01 Sample Color Pinkish Gray
7. USCS Classification CL
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ____
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Fuel (Strong)
13. Is Gross Contamination present? (Y or N) No
14. Additional Information All layers seemed saturated. End of Boring 3.0'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Trace of Silt (SP), Dark Reddish Brown (5YR 2.5/2), Moist	2 ppm
1	Poorly Graded Fine Sand with Clay (SP-SC), Gold/Light Olive Brown (2.5Y 5/5), Subangular, Moist, Medium Dense	5 ppm
2	Well Graded Medium Sand (SW), Pinkish Gray (5YR 6/2), Subangular, Very Moist, Dense, Strong Odor	60 ppm
3		170 ppm
4		
5		

Signed ____ Date 5/24/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 11:00 am Hand Auger Boring No. 05-HA-02
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 5 mph, Precipitation 0" Last 24 hr, Air Temperature 74°
6. Sample Identification No. 05-HA-02 Sample Color Yellowish Red
7. USCS Classification SW
8. Relative Moisture Content (Dry, Moist, Saturated) Slightly Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ____
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ____
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.25'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand (Topsoil) with Surface Organics (SP), Dark Reddish Brown (5YR 2.5/2), Moist	1 ppm
1	Well Graded Fine Sand (SW), Yellowish Red (5YR 5/6), Slightly Moist, Medium Dense, Very Little Odor	4 ppm
2		1 ppm
3		
4		
5		

Signed ____ Date 5/24/90

CH2M HILL®

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 11:20 am Hand Auger Boring No. 05-HA-03
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 5 mph, Precipitation 0" Last 24 hr, Air Temperature 73°
6. Sample Identification No. 05-HA-03 Sample Color Grayish Green & Gold
7. USCS Classification SC
8. Relative Moisture Content (Dry, Moist, Saturated) Very Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ______
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Fuel
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Silt (SP-SM) and Surface Organics, Black (5YR 2.5/1), Loose, Moist, Slight Odor	170 ppm
1	Clayey Sand (SC), Mottled Grayish Green/Gold (10YR 6/6—Brownish Yellow), Slightly Plastic, Very Moist, Very Dense, Strong Fuel Odor	
2		200 ppm
		220 ppm
3		220 ppm
		180 ppm
4		
5		

Signed ______ Date 5/24/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 11:45 am Hand Auger Boring No. 05-HA-04
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1203 , Reading See Below
5. Weather: Wind 5 mph , Precipitation 0" Last 24 hr , Air Temperature 75°
6. Sample Identification No. 05-HA-04 Sample Color Gray & Orange
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Very Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.5'
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Fuel
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Silt and Surface Organics (SP-SM), Black (5YR 2.5/1), Moist, Loose, Slight Odor	50 ppm
1	Poorly Graded Fine Sand (SP), Mottled Orange-Yellow and Gray (7.5YR 7/8—Reddish-Yellow), Subangular, Moist, Dense, Strong Odor	190 ppm
2		180 ppm
		150 ppm
		160 ppm
3		190 ppm
	Sandy Lean Clay (CL), Reddish-Yellow (7.5YR 7/8), Very Moist, Dense, Strong Odor, Slightly Plastic	180 ppm
4		
5		

Signed ____________ Date 5/24/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 Hand Auger Boring No. 05-HA-05
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 5-10 mph , Precipitation 0" Last 24 hr , Air Temperature 74°
6. Sample Identification No. 05-HA-05 Sample Color Light Gray Fine Sand
7. USCS Classification SP-SC
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.75'
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Fuel
13. Is Gross Contamination present? (Y or N) No
14. Additional Information GC sample taken at 1.0'. End of Boring 2.75'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Silt (SP-SM) Silty Fine Sand, Gray (5YR 2.5/1—Black), Subangular, Loose, Moist, Strong Odor	80 ppm
1		150 ppm*
	Poorly Graded Sand with Clay (SP-SC), Light Gray (10YR 6/1), Non-Plastic, Medium Dense, Strong Odor	
2	Sandy Lean Clay (CL), Mottled Gray and Orange (5YR 5/8—Yellowish Red), Moist, Dense, Strong Odor	100 ppm
3		
4		
5		

Signed ______ Date 5/24/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 4:35pm Hand Auger Boring No. 05-HA-06
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 10 mph , Precipitation 0" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 05-HA-06 Sample Color Gray
7. USCS Classification SC
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.75'
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Fuel
13. Is Gross Contamination present? (Y or N) No
14. Additional Information GC sample taken at 2.5'. End of Boring 2.75'

Soil Profile

Depth	Soil Description	PID Screening Results
0–1	Poorly Graded Fine Sand with Trace of Clay and Silt (SP), Very Dark Gray (10YR 3/2), Slightly Moist, Medium Dense, No Odor	0.5 ppm
1–2.4	Clayey Sand with Trace of Silt (SC), Very Dark Gray (10YR 3/1), Saturated, Loose, Subangular	
2.4–2.75	Sandy Lean Clay (CL), Yellowish Brown (10YR 5/6), Slight Plasticity, Wet, Very Dense/Stiff, Slight Odor	150 ppm* 20 ppm
3		
4		
5		

Signed ______________________ Date 5/24/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 4:55pm Hand Auger Boring No. 05-HA-07
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 10 mph , Precipitation 0" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 05-HA-07 Sample Color Gray (2.5Y 2.5/0)
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.0'
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Petroleum
13. Is Gross Contamination present? (Y or N) No
14. Additional Information GC sample taken at 3.0'. End of Boring 3.0'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Fine Sand with Trace of Silt and Surface Organics (SP), Brown (10 YR 3/2)	2 ppm
1	Poorly Graded Fine Sand with Trace of Silt (SP), Mottled Gray and Weak Red (2.5YR 4/2), Moist, Medium Dense	
2	Poorly Graded Fine Sand (SP), Black (2.5YR 2.5/0), Subangular, Saturated at 3' bls, Medium Dense, Stong Fuel Odor	100 ppm 70 ppm 20 ppm
3		105 ppm*
4		
5		

Signed ______ Date 5/24/90

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HAND AUGER SAMPLING FORM

1. Date/Time 5/24/90 5:15pm Hand Auger Boring No. 05-HA-08
2. Location Site No. 5
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 10 mph, Precipitation 0" Last 24 hr, Air Temperature 72°
6. Sample Identification No. 05-HA-08 Sample Color Dark Brown
7. USCS Classification CL
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ____
13. Is Gross Contamination present? (Y or N) No
14. Additional Information GC sample taken at 2.5'. End of Boring 2.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand (SP), Dark Brown (10YR 3/3), Loose, Dry	
	Poorly Graded Sand with Clay (SP-SC), Dark Yellowish Brown (10YR 4/4), Moist Medium Dense	
1	Sandy Lean Clay (CL), Very Dark Brown (10YR 2/2), Subangular, Moist, Medium Dense, No Odor	Trace
2		
3		
4		
5		

Signed ____________ Date 5/24/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/21/90 5:30 pm Hand Auger Boring No. 06-HA-01
2. Location Site No. 6 Southwest corner of grid on grass
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind ~ 10 mph from S, Precipitation 1/4" Last 24 hr, Air Temperature ~ 88°
6. Sample Identification No. 06-HA-01 Sample Color Very Dark Gray
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No - In Field GC
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.5
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Surface Organics (SP), Dark Gray (2.54 4/0), Dry, Dense, Silica Sand	
	Poorly Graded Sand with Silt (SP-SM), Yellowish-Brown (10YR 5/4), Dry Dense, No Odor	0 ppm
1		
2	Poorly Graded Fine Sand (SP), Gray (2.5Y 5/0), Dry, Very Dense, No Odor	0 ppm
3	Poorly Graded Fine Sand with Silt (SP-SM), Very Dark Gray (10YR 3/1), Moist, Very Dense, Subangular Particles, Slight Odor of Decaying Organic Material,	*For GC
4		
5		

Signed ______ Date 5/21/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/21/90 6:40 pm Hand Auger Boring No. 06-HA-02
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind ~ 10 mph from S , Precipitation 1/4" Last 24 hr , Air Temperature ~ 88°
6. Sample Identification No. 06-HA-02 Sample Color Dark Gray
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) Yes
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons X Total Petroleum Hydrocarbons X
    Volatile Organics X Priority Pollutant Metals X
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Surface Organics (SP), Gray (2.54 4/0), Dry, Dense	0 ppm
1	Poorly Graded Fine Sand (SP), Mottled Gray and Tan (7.5YR 5/4-Brown), Moist, Medium Dense	0 ppm
2	Poorly Graded Fine Sand with Silt (SP-SM), Black (10YR 2/1), Very Moist, Dense	
3	Poorly Graded Medium Sand (SP), Mottled Tan and Dark Gray (10YR 7/2 to 10YR 3/1), Coarser than above, Subangular Particles, Moist, Dense	* For GC * For LAB
4		
5		

Signed Date 5/21/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/21/90 7:30 pm Hand Auger Boring No. 06-HA-03
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind No, Precipitation 1/4" Last 24 hr, Air Temperature 84°
6. Sample Identification No. 06-HA-03 For GC Sample Color Dark Brown/Copper
7. USCS Classification SP - SC
8. Relative Moisture Content (Dry, Moist, Saturated) Moist and Loose
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.0'
12. Does Material Have Contaminant Odor? (Y or N) Yes If Yes, Describe Unidentifiable
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Silt (SP-SM), Dark Gray (2.5YR 4/0), Dry, Dense	0 ppm
1	Poorly Graded Fine Sand with Small (<1/4") Nodules of Cemented Sand (SP), Brown (7.5YR 5/4), Moist, Dense, No Odor	0 ppm
2	Poorly Graded Sand with Clay (SP-SC), Very Dark Gray (2.5YR 3/0), Moist, Dense, Slightly Plastic, Strong Organic Odor	* GC 0 ppm
3	Poorly Graded Fine Sand with Silt (SP-SM), Very Dark Gray Poorly Graded Silty Fine Sand (SP-ML), Gray (7.5YR 2.5/0)	0 ppm
4	As Above Without Clay, Moist, Dense, Strong Decaying Organic Odor	
5		

Signed ______________________ Date 5/21/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/21/90 7:45 pm Hand Auger Boring No. 06-HA-04
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind None, Precipitation 1/4" Last 24 hr, Air Temperature 83°
6. Sample Identification No. 06-HA-04 Sample Color Dark Gray
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade ~4'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Surface Organics and Roots (SP). Very Dark Gray (2.5YR 4/0), Moist, Medium Dense, No Odor	0 ppm
1	Sandy Organic Soil (OL), Black (2.5YR 2.5/0), Moist, Loose	0 ppm
2	Poorly Graded Fine Sand with Silt (SP-SM), Dusky Red (2.5YR 3/2), Moist, Medium Dense	0 ppm
3	Poorly Graded Fine Sand with Silt and Roots, Gray, Moist, Loose	* GC
4	Silty Sand with Organics (SM), Black (2.5YR 2.5/0), Saturated, Medium Dense, No Odor	0 ppm
5		

Signed ______ Date 5/21/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 12:00 pm Hand Auger Boring No. 06-HA-05
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15 mph from N.W. Precipitation 1/2" Last 24 hr , Air Temperature 70°
6. Sample Identification No. 06-HA-05 Sample Color Dark Reddish Brown
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Very Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ____
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.25'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Surface Organics (SP), Reddish Brown, Loose, Dry	0 ppm
1	Poorly Graded Fine Sand with with Roots (SP), Slightly Moist, Medium Dense, Roots Produced HNU Response	15 ppm
2	Poorly Graded Fine Sand with Trace of Silt (SP), Dark Reddish Brown (5YR 2.5/2), Very Moist, Medium Dense	0 ppm * GC
3	Poorly Graded Fine Sand (SP), as above Without Silt, Dark Reddish Brown (5YR 2.5/2), Saturated, Medium Dense, Subangular Quartz Sand	0 ppm
4		
5		

Signed ____ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/23/90 2:30 pm Hand Auger Boring No. 06-HA-06
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind Calm , Precipitation 0" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 06-HA-06 Sample Color Dark Gray
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.25'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information * Sample Collected at 2.0' / End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0–1	Poorly Graded Fine Sand with Silt and Surface Organics (SP-SM), Dark Gray (5YR 4/1), Moist, Loose	1 ppm
1		5 ppm
1–3.5	Poorly Graded Fine Sand with Roots (SP), Very Dark Gray (7.5YR 2.5/0), Very Moist, Medium Dense, Slight Decaying Organic Odor	*Field GC 1 ppm
3.5	EOB	
4		
5		

Signed ______ Date 5/23/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 5:30 pm Hand Auger Boring No. 06-HA-07
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 20 mph from N.W., Precipitation 1/2" Last 24 hr, Air Temperature 75°
6. Sample Identification No. 06-HA-07 Sample Color Light Gray
7. USCS Classification SW
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ____
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ____
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Organic Soil and Roots (OL), Dark Reddish Brown to Black, Loose, Slightly Moist	0 ppm
1–3	Poorly Graded Fine Sand with Clay (SP-SC), Dark Reddish Brown (5.0YR 2/5/2), Slightly Plastic, Moist, Medium Dense	
3	Well Graded Medium Fine Sand (SP), Light Gray (10YR 7/1), Very Moist, Medium Dense, Subangular Quartz Grains	1 ppm *GC
		EOB
4		
5		

Signed ____ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 4:25 pm Hand Auger Boring No. 06-HA-08
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 20 mph from N.W., Precipitation 1/2" Last 24 hr, Air Temperature 75°
6. Sample Identification No. 06-HA-08 Sample Color Light Gray
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Moist to Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) Yes
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons Yes Total Petroleum Hydrocarbons Yes
    Volatile Organics Yes Priority Pollutant Metals Yes
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.25'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe
13. Is Gross Contamination present? (Y or N) No
14. Additional Information Blind duplicate taken on this boring. Duplicate labeled 06-HA-BD, samples taken at 2' / End of Boring 2.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0		
1	Poorly Graded Fine Sand with Silt and Surface Organics (SP-SM), Black (5.0YR 2.5/1), Moist, Medium Dense, Slight Decaying Organic Odor, HNU Response Produced from Roots	6 ppm
2	Poorly Graded Fine Sand (SP), Light Gray (10YR 7/1), Subrounded Quartz Grains, Very Moist to Saturated, Very Dense	1 ppm * Lab Sample and Dup. * GC Sample
	EOB	
3		
4		
5		

Signed ______________ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 1:25 pm Hand Auger Boring No. 06-HA-09
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 15-20 mph from N.W., Precipitation 1/2" Last 24 hr, Air Temperature 72°
6. Sample Identification No. 06-HA-09 Sample Color Dark Reddish Brown
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Moist
9. Is Sample Being Analyzed in Lab? (Y or N) Yes
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons Yes Total Petroleum Hydrocarbons Yes
    Volatile Organics Yes Priority Pollutant Metals Yes
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.25'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe
13. Is Gross Contamination present? (Y or N) No
14. Additional Information Field GC taken at 2'. Lab sample taken at 2.5' / End of Boring 2.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Poorly Graded Fine Sand with Silt and Surface Organics, Dark Gray, Moist, Loose	0 ppm
1	Poorly Graded Fine Sand with Silt (SP-SM), Dark Reddish Brown (5YR 2.5/2), Moist, Medium Dense, No Odor	
2		* Field GC * Lab Sample
3		
4		
5		

Signed Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 12:20 pm Hand Auger Boring No. 06-HA-10
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15-20 mph , Precipitation 1/2" Last 24 hr , Air Temperature 70°
6. Sample Identification No. 06-HA-10 Sample Color Dark Reddish Brown
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 1.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information ______

Soil Profile

Depth	Soil Description	PID Screening Results
0		0 ppm
1	Poorly Graded Fine Sand with Silt (SP-SM), Dark Reddish Brown (5YR 2.5/2), Some Roots, Moist, Medium Dense, No Odor	0 ppm Groundwater
2		
3		
4		
5		

Signed ______ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/23/90 2:10 pm Hand Auger Boring No. 06-HA-11
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind Calm , Precipitation 0" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 06-HA-11 Sample Color Light and Dark Gray Intermixed
7. USCS Classification SW-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Very Moist/Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ______
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.25'

Soil Profile

Depth	Soil Description	PID Screening Results
0–2	Poorly Graded Fine Sand with Surface Organics and Roots (SP), Trace of Silt, Dark Gray (5YR 3/1), Loose, Moist	Trace 0+ ppm
2–3.25	Well Graded Fine Sand with Trace of Silt (SW-SM), Mottled Dark and Light Gray (10YR 7/1 and 5YR 2.5/2), Subangular Particles, Very Moist, Dense	0 ppm * GC Sample
3.25–5		

Signed ______ Date 5/23/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 5:05 pm Hand Auger Boring No. 06-HA-12
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 20 mph from N.W. Precipitation 1/2" Last 24 hr , Air Temperature 75°
6. Sample Identification No. 06-HA-12 Sample Color Dark Gray
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) No If Yes, Depth Below Surface Grade ______
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.25'

Soil Profile

Depth	Soil Description	PID Screening Results
0		
		0 ppm
1		
	Poorly Graded Fine Sand with Trace of Silt (SP), Dark Reddish Brown (5YR 2.5/2), Increasing Moisture with Depth, Medium Dense, Some Roots, No Odor	0 ppm
2		
3		
4		
5		

Signed ______ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 4:05 pm Hand Auger Boring No. 06-HA-13
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15-20 mph from N.W., Precipitation 1/2" Last 24 hr , Air Temperature 75°
6. Sample Identification No. 06-HA-13 Sample Color Dark Gray To Black
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 3.0'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 3.0'

Soil Profile

Depth	Soil Description	PID Screening Results
0	Surface Organics and Organic Soils	
1		5 ppm
2	Poorly Graded Sand With Silt (SP-SM), Dark Gray to Black (5YR 3/1), Slight Decaying Organic Odor, Increasing Moisture with Depth, Medium Dense	14 ppm * GC
3		1.5 ppm
4		
5		

Signed ______ Date 5/22/90

CH2MHILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 12:50 pm Hand Auger Boring No. 06-HA-14
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206, Reading See Below
5. Weather: Wind 15 mph from N.W. Precipitation 1/2" Last 24 hr, Air Temperature 72°
6. Sample Identification No. 06-HA-14 Sample Color Dark Gray
7. USCS Classification SP
8. Relative Moisture Content (Dry, Moist, Saturated)
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 2.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0		
		5 ppm
1	Well Graded Fine Sand with Roots (SW), Dark Gray (5YR 3/1), Moist, Medium Dense, Subangular Particles, No Odor	
		0 ppm
2	Clayey Sand (SC), Black (5YR 2.5/1), Loose, Wet, No Odor ▽	* GC Sample
	Poorly Graded Fine Sand with Roots (SP), Black (5 YR 2.5/1), No Fines, Saturated, Medium Dense, No Odor	
3		
4		
5		

Signed ______________ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 12:30 pm Hand Auger Boring No. 06-HA-15
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15 mph from N.W., Precipitation 1/2" Last 24 hr , Air Temperature 71°
6. Sample Identification No. 06-HA-15 Sample Color Dark Gray to Black
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.0'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 2.0'

Soil Profile

Depth	Soil Description	PID Screening Results
0		
		0 ppm
1	Poorly Graded Fine Sand with Silt (SP-SM), Dark Gray to Black (5YR 2.5-3/1), Increasing Moisture with Depth, Medium Dense, No Odor	
2		* GC Sample
3		
4		
5		

Signed ______ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 1:55 pm Hand Auger Boring No. 06-HA-16
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15-20 mph from N.W., Precipitation 1/2" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 06-HA-16 Sample Color Very Dark Gray
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Very Moist
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled
    Polynuclear Aromatic Hydrocarbons ____ Total Petroleum Hydrocarbons ____
    Volatile Organics ____ Priority Pollutant Metals ____
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.25'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ____
13. Is Gross Contamination present? (Y or N) No
14. Additional Information End of Boring 2.25'

Soil Profile

Depth	Soil Description	PID Screening Results
0		Trace
1	Poorly Graded Fine Sand with Silt and Roots (SP-SM), Very Dark Gray (5YR 3/1), Moist, Medium Dense, Slight Decaying Organic Odor	
2	▽	1-2 ppm * GC
3		
4		
5		

Signed ____ Date 5/22/90

CH2M HILL

HAND AUGER SAMPLING FORM

1. Date/Time 5/22/90 5:55 pm Hand Auger Boring No. 06-HA-17
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind 15 mph from N.W. Precipitation 1/2" Last 24 hr , Air Temperature 73°
6. Sample Identification No. 06-HA-17 Sample Color Dark Gray
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) Yes
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons X Total Petroleum Hydrocarbons X
    Volatile Organics X Priority Pollutant Metals X
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 2.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe
13. Is Gross Contamination present? (Y or N) No
14. Additional Information Field GC taken at 2'. Lab sample taken at 2.0' and 2.5'/ End of Boring 2.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0–2	Poorly Graded Fine Sand (SP), Dark Gray (5YR 3/1), Moist to 2' bls, Medium Dense, No Odor	0 ppm
2	Poorly Graded Fine Sand with Silt and Trace of Clay (SP-SM), Dark Gray (5YR 3/1), Loose, Wet	0 ppm * GC/Lab
2.5	Poorly Graded Sand with Clay (SP-SC), Dark Gray (5YR 3/1), Loose, Saturated, No Odor	* Lab Sample 0 ppm

Signed Date 5/22/90

HAND AUGER SAMPLING FORM

1. Date/Time 5/23/90 3:05 pm Hand Auger Boring No. 06-HA-18
2. Location Site No. 6
3. Sampler R. Olson Other Present S. Holzgen
4. Organic Vapor Decector FEL No. 1206 , Reading See Below
5. Weather: Wind Calm , Precipitation 0" Last 24 hr , Air Temperature 78°
6. Sample Identification No. 06-HA-18 Sample Color Dark Gray
7. USCS Classification SP-SM
8. Relative Moisture Content (Dry, Moist, Saturated) Saturated
9. Is Sample Being Analyzed in Lab? (Y or N) No
10. Parameters Sampled For:
    Polynuclear Aromatic Hydrocarbons ______ Total Petroleum Hydrocarbons ______
    Volatile Organics ______ Priority Pollutant Metals ______
    Field Gas Chromatograph Yes
11. Was Groundwater Encountered ? (Y or N) Yes If Yes, Depth Below Surface Grade 1.5'
12. Does Material Have Contaminant Odor? (Y or N) No If Yes, Describe ______
13. Is Gross Contamination present? (Y or N) No
14. Additional Information Sample taken at edge of standing water. Lowest point at Site No. 5.
    End of Boring at 1.5'

Soil Profile

Depth	Soil Description	PID Screening Results
0		
0–1.5	Poorly Graded Fine Sand with Silt and Organics (SP-SM), Dark Gray 95YR 3/1), Loose, Saturated, Organic Odor	*GC 1.5 ppm
1.5–5	Poorly Graded Sand with Silt (SP-SM), Black (2.5Y 2/0), Loose, Saturated, No Odor	
5		

Signed ______ Date 5/22/90

Soil Boring Logs

SOIL BORING LOG

Date: 06-28-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 01-SB-01
Installation: Savannah
Site No. 1
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I. Driller: L. Blodsoe
Drilling Start: 11:25 am Drilling End: 12:00 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'	01-SB-01	1	Yes		Yes	18"	Fine Sand, 10 YR 7/3 Very Pale Brown, Medium Dense, Hard & Dry, w/ Surface Organics, Sampled for Lab & Field GC (0-2')	SP	3 6 6 9	12	HNμ = 0 ppm
						18"	Fine Sand,7.5 YR 3.5/5 Strong Brown, Dense, Clean & Dry, No Odor, HNμ = 0, No Detection	SP	10 15 18 20	33	HNμ = 0 ppm
						24"	Fine Sand,10 YR 5/6 Yellowish Brown, Medium Dense,Slightly Moist, No Odor, Poorly Graded, Mottled Orange and Brown	SP	10 12 15 15	27	HNμ = 0 ppm
						24"	Fine Sand, 10 YR 5/1 Gray, Loose, Slightly Moist to 9', No Odor, Poorly Graded, Mottled Tan and Gray	SP	6 5 3 4	8	HNμ = 0 ppm
						24"		SP	4 6 9 14	15	HNμ = 0 ppm
						24"	Fine Sand, 10 YR 7/1 Light Gray, Medium Dense, Slightly Damp, No Fines, No Odor	SP	7 5	9	HNμ = 0 ppm
							Clayey Sand, 10 YR 6/2 Light Brownish Gray, Medium Stiff, Some Plasticity, Well Graded, No Odor	SC	4 3		
12-14'	01-SB-01	2	Yes		Yes	24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray, Medium, Some Plasticity, Well Graded, No Odor Sampled for Lab & Field GC (12-14')	SC	4 4 3 8	7	HNμ = 0 ppm
							EOB - 14' BLS WL - 12' 5" BLS Samples 01-SB-01 (0-2) 11:28 01-SB-01 (12-14) 11:52				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level 12.5' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-27-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 02-SB-01

Installation: Savannah
Site No. 2

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe
Drilling Start: 9:40 am Drilling End: 10:10 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	1	02-SB-01	Yes		Yes		Fine Sand, 7.5 YR 3/2 Dark Brown, Medium Dense, Dry, w/ Trace Surface Organics Fine Sand, 7.5 YR 4/0 Dark Gray, Medium Dense, Dry Sampled for Lab & Field GC (0-2')	SP	3 4 7 8	11	HNμ = 0 ppm
							Fine Sand with Trace of Clay, 7.5 YR 5/6 Strong Brown, Loose, Slightly Moist, Mottled orange and gold, No Odor	SP	3 3 6 7	9	HNμ = 0 ppm
							Medium Caley Sand, 2.5 Y 5/2 Grayish Brown, Medium Stiff, Moist, No Odor	SC	2 3 4 6	7	HNμ = 0 ppm
6-8'	2	02-SB-01	Yes		Yes	24"	Sand w/ Clay, 2.5 Y 5/2 Grayish Brown, Stiff, Wet, Sample for Lab & Field GC 02-SB-01 (6-8')	SC	6 9 7 6	16	HNμ = 0 ppm
						24"	Clay with Sand, 5 Y 5/1 Gray, Medium Stiff, Saturated, Highly Plastic	CH	3 3 2 1	3	HNμ = 0 ppm
							EOB - 10' BLS WL - ~6' BLS Samples 02-SB-01 (0-2) 9:40 02-SB-01 (6-8) 9:52				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 6' bls

U = Thin wall tube R = Rock coring N/A
Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A
G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-26-90

Client/Project: Georgia Air National Guard | BORING/WELL No. 05-SB-01

Installation: Savannah | Site No. 5

HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0.02

Logged by: R. Olson | Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe | Drilling Start: 2:20 pm Drilling End: 2:40 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 | Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS	
						N/A	Post Holed to 2' to check for utilities Fine Sand, 7.5 YR 5/2 Brown, Dense, Dry	SP	UK	UK	HNμ = 0 ppm	2
							Silty - Fine Sand SP - ML		2			
						12"	Sandy Clay, 10 YR 6/6 Brownish Yellow, Soft, Slightly Moist, Loose	SC	2 2 3	4	HNμ = 0 ppm	4
	05-SB-01	1 - Yes	Yes		Yes	24"	Sandy Clay, 10 YR 6/2 Light Brownish Gray, Stiff, Moist, Dense - Sampled for Lab & Field GC Collected Lab Sample and Sample for Head Space Sample wouldn't go in sleeve collected in bottle	SC	4 5 6 10	11	HNμ = 0 ppm	6
6-8	05-SB-01	2 - Yes	Yes		Yes	24"	Sandy Clay, 10 YR 5/1 Gray, Very Stiff, Moist, Plastic Silty Fine Sand, 2.5 Y 6/3 Light Yellowish Brown, Medium Dense, Saturated - Sampled for Lab & Field GC	SC SM	10 16 9 7	25	HNμ = 0 Exp. - 0 O_2 = 20.8	Water Level 7.6' bls 8
							EOB - 8' BLS Water - 7.6' BLS					12 14

U = Thin wall tube | R = Rock coring N/A | Field G/C (Make/Mod.) Photo Vac 10-S-5?

S = Split spoon (tube) | O = Other N/A | G/C Oper.: S. Holzgen

C = Cuttings | Notes:

SOIL BORING LOG

Date: 06-26-90

Client/Project: Georgia Air National Guard | BORING/WELL No. 05-SB-02

Installation: Savannah | Site No. 5

HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0.02

Logged by: R. Olson | Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe | Drilling Start: 2:50 pm Drilling End: 3:35 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 | Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch	N - Value	COMMENTS
						N/A	Post Holed to 2' to check for utilities - none encountered Fine Sand, 2.5 YR 2.5/0 Black, Dense, w/ Surface Organics,	SP	UK		HNμ = 0 O_2 = 21%
2' - 4'	05-SB-02		Yes		Yes	18"	Fine Sand, 10 YR 3/2 Very Dark Grayish Brown, Loose, Dry - Sampled for Lab & Field GC	SP	3 5 4	9	
							Silty Fine Sand, 7.5 YR 3/2 Dark Brown, Moist, Loose	SP	4		Hole Collapsed at 4.5'
						24"		SP	4	12	
							Sandy Clay, 7.5 YR 3/2 Dark Brown, Stiff, Very Moist, Large Roots, No Odor/Trace of Organics, Plastic	CH	4 8 8		
6' - 8'	05-SB-02		Yes		Yes	24"	Sandy Clay, 10 YR 5/1 Gray, Stiff Sampled for Lab & Field GC 6 - 8' Set Auger to 6' - Drove 6 - 8'	CL	5 5 5 5	10	
						24"	Sand w/ Trace of Clay, 10 YR 5/1 Gray, Loose, Saturated	SP	4 3 3 2	6	HNμ = 0 ppm
							EOB - 10' BLS Water - 8' BLS Samples 05-SB-02 (2-4) 05-SB-02 (6-8)				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 8' bls

U = Thin wall tube R = Rock coring N/A | Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A | G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-26-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 05-SB-03

Installation: Savannah — Site No. 5

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe — Drilling Start: 4:00 pm — Drilling End: 4:55 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ()	Recovery (IN)	Lithologic Description	USCS	Blows / 6 inch	N - Value	COMMENTS	Depth scale
							Silty Fine Sand, 5 YR 5/1 Gray, Dense Dry Post Holed to 1.5' to Check for Utilities	SM	N/A		HNμ = 0 ppm	
1' - 3'	05-SB-03		Yes		Yes	18"	Silty Fine Sand, 5 YR 5/1 Gray, Loose, Dry - Sampled for Lab & Field GC (1-3') Grabbed Blind Duplicate D1	SM	11, 5, 2, 2	7	HNμ = 0 ppm	2
						12"	Sandy Clay, 5 YR 5/1 Gray, Loose, Moist	SC	2, 4	9	HNμ = 0 ppm	4
							Clay w/ Sand, 5 YR 5/1Gray, Stiff, Moist, Plastic	CL	5, 5			
						12"	Sandy Clay, 10 YR 6/2 Light Brownish Gray, Medium Dense, Moist - Lower PL than above	SC	7, 7, 8, 10	15	HNμ = 0 ppm	6
						6"	Sandy Clay, 10 YR 3/1 V..y Dark Gray, Very Stiff, Slightly Moist, Medium Plastic, Set Auger at 9' bls.	CL	7, 9, 8, 6	17	HNμ = 0 ppm	8
9' - 11'	05-SB-03		Yes		Yes	6"	Drove Sampler to Same Interval 2 Times to Yeild Sample Medium Sand, 5Y 5/1 Gray, Medium Dense, Saturated Sample for Lab & Field GC (9-11')	SP	8, 6, 6, 6	12	HNμ = 0 ppm	10 Water Level 8.9' bls
						24"	Sandy Clay, 5Y 4.5/1 Gray to Dark Gray, Very Soft, Saturated	SC	1, 1, 1, 1	2	HNμ = 0 ppm	12
							EOB - 13' BLS Water - 8.9' BLS Samples: 05-SB-03 (0-1) 05-SB-03 (D1) 05-SB-03 (9-11)					EOB 13' 14

U = Thin wall tube — R = Rock coring N/A — Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) — O = Other N/A — G/C Oper.: S. Holzgen

C = Cuttings — Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-26-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 05-SB-04

Installation: Savannah — Site No. 5

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe — Drilling Start: 5:15 pm Drilling End: 5:45 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS	Depth scale
0-2'	05-SB-04		Yes		Yes	24"	Fine Sand, 5YR 5/1 Gray, Medium Dense, Gas Odor, Surface Organics - Sampled for Lab & GC	SP	6 6 5 3	11	HNμ = 50 ppm	2
						24"	Sandy Clay, 10 YR 6/6 Brownish Yellow, Medium Stiff, Damp, Strong Fuel Odor	SC	2 4 5 5		HNμ = 50 ppm	4
						24"	Sandy Clay, 5 Y 6/2 Light Olive Gray, Very Stiff, Moist, Plastic, Very Strong Fuel Odor	SC	10 10 10 12		HNμ = 100+ ppm	6
						24"	Sandy Clay, 5 Y 6/2 Light Olive Gray, Stiff, Moist, Plastic, Very Strong Fuel Odor	SC	6 6 7 6		HNμ = 100+ ppm	Water Level 7.7' bls 8
8-10'	05-SB-04		Yes		Yes	24"	Fine Sand, 5 Y 6/1 Gray, Very Loose, Saturated, No Odor - Sampled for Lab & Field GC	SP	2 1 2 2		HNμ = 1 ppm	10
							EOB - 10' BLS WL - 7.7 ' BLS Samples 05-SB-04 (1-2') 05-SB-04 (8-10')					12 14

U = Thin wall tube — R = Rock coring N/A — Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) — O = Other N/A — G/C Oper.: S. Holzgen

C = Cuttings — Notes:

SOIL BORING LOG

Date: 06-27-90

Client/Project: Georgia Air National Guard | BORING/WELL No. 05-SB-05

Installation: Savannah | Site No. 5

HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0.02

Logged by: R. Olson | Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe | Drilling Start: 8:10 am Drilling End: 8:50 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 | Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_Hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS	
0-2'	05-SB-05		Yes		Yes	12"	Fine Sand, 7.5 YR 4/2 Dark Brown, Medium Dense, Dry, No Odor, Surface Organics Medium Fine Sand, 7.5 YR 6/8 Reddish Yellow, Medium Dense, Dry, No Odor, Trace of Clay, Mottled Orange & Brown	SP SW	10 9 4 3	13	HNμ = 0 ppm	2
						18"		SW	4 5 6 7	11	HNμ = 0 ppm	4
						24"	Clayey Sand, 10 YR 6/3 Pale Brown, Medium Stiff, Moist to Wet, No Odor - Sample for Lab & Field GC, & MS/MSD	SW SC	7 6 5 6	11	HNμ = 0 ppm	6
6-8'	05-SB-05		Yes		Yes	24"		SC	5 4 4 3	8	HNμ = 0 ppm	8 Water Level 7.8' bls
						24"	Clayey Sand, 2.5 Y 6/2 Light Brownish Gray, Soft, Wet, No Odor	SC	3 3 2 1	5	HNμ = 0 ppm	10
							EOB - 10' BLS WL - 7.8'					12 14

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-28-90

Client/Project: Georgia Air National Guard

BORING/WELL No. 07-SB-01

Installation: Savannah

Site No. 7

HAZWRAP Contractor: CH2M HILL

Project No. SEF27794.C0.02

Logged by: R. Olson

Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe

Drilling Start: 9:14 am Drilling End: 9:20 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57

Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	07-SB-01	1	No		No	12"	Fine Sand, Reddish Brown, Medium Dense, Slightly Moist, No Odor, w/ Surface Organics	SP	4 10 10 7	20	HNμ = 0 ppm
						24"	Fine Sand, Reddish Brown, Medium Dense, Slightly Moist, No Odor, w/ Surface Organics, Large Diameter Roots	SP		UK	HNμ = 60+ ppm
							Fine Sand, Gray, Fuel Odor, Visible Contamination, Grossly Contaminated - Appears to have Free Product	SP			
							Abandoned Bore Hole No Samples - Moved North From Fence EOB - 4' BLS				

Depth scale: 2, 4, 6, 8, 10, 12, 14

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) N/A

S = Split spoon (tube) O = Other N/A G/C Oper.: N/A

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-28-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 07-SB-02

Installation: Savannah — Site No. 7

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe — Drilling Start: 9:30 am Drilling End: 10:05 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'	07-SB-02	1	Yes		Yes	15"	Fine Sand, 2.5 Y 3.5/0 Very Dark Gray, Medium Dense, Dry, Clean w/ Surface Organics, Sampled for Lab & Field GC	SP	2 12 14 12	26	HNμ = 2 ppm
						18"	Fine Sand with Clay, 10 YR 3.5/2 Dark Grayish Brown, Medium Stiff, Slightly Moist, No Odor, HNμ Detection,	SC	4 5 4 3	9	HNμ = 4 ppm
4-6'	07-SB-02	2	Yes		Yes	13"	Sandy Clay, 10 YR 3.5/2 Dark Grayish Brown, Stiff, Wet, Rotting Organic Odor, Sampled for Lab & Field GC	SC	4 4 7 7	11	HNμ = 0 ppm
						24"	Medium Sand with Trace of Clay, 10 YR 5/3 Brown, Medium Dense, Saturated, No Odor, Poorly Graded, Non-Plastic	SP	7 7 14 7	21	HNμ = 1 ppm
							EOB - 8' BLS WL - 5' BLS Samples 07-SB-02 (0-2) 9:35 07-SB-02 (4-6) 10:00				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 5' bls

U = Thin wall tube — R = Rock coring N/A — Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) — O = Other N/A — G/C Oper.: S. Holzgen

C = Cuttings — Notes:

CH2M HILL

SOIL BORING LOG

Date: 06-29-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 08-SB-01

Installation: Savannah
Site No. 8

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe
Drilling Start: 11:18 am Drilling End: 12:05 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS	
0-2'	08-SB-01	1	Yes		Yes	18"	Fine Sand, 10 YR 4/1 Dark Gray, Medium Dense, Very Dry, Surface Organics Sampled for All Parameters and MS/MSD	SP	4 9 8 9	17	HNμ = 0 ppm Exp. - ok	2
						18"	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Dense, Dry, Fill Material, Mottled Tan and Gray, No Odor	SP	9 14 18 20	32	HNμ = 0 ppm Exp. - ok	4
						24"	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Very Dense, Moist, No Odor, Fill Material, Mottled Tan and Gray - As Above	SP	20 35 35 35	70	HNμ = 0 ppm Exp. - ok	6
						24"	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Moist, Fill Material, No Odor, As Above	SP	9 13 11 9	N/A	HNμ = 0 ppm Exp. - ok	8
8-10'	08-SB-01	2	Yes		Yes	24"	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Moist, Some Roots, Sampled All Parameters Fine Sand, 10 YR 3/1 Very Dark Gray, Medium Dense, Wet, No Odor, No Fines	SP	12 12 10 14	N/A	HNμ = 0 ppm Exp. - ok	10
						12"	Fine Sand, 10 YR 3/2 Very Dark Grayish Brown, Loose, Satured, Rotting Organic Odor, No HNμ Detection, Poorly Graded	SP	5 5 2 1	N/A	HNμ = 0 ppm Exp. - ok	Water Level 11' bls 12
							EOB - 12' BLS WL - ~11' BLS Sample Summary 08-SB-01 (0-2) 11:19 /MS/MSD 08-SB-01 (8-11') 11:50					14

U = Thin wall tube R = Rock coring N/A
Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A
G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-29-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 08-SB-02

Installation: Savannah
Site No. 8

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe
Drilling Start: 12:20 pm Drilling End: 12:55 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'	08-SB-02	1	Yes		No	15	Fine Sand, 7.5 YR 4.5/2 Dark Brown, Medium Dense, Dry, Sampled TPH, PAH, &P.P. Metals and Duplicate (D4)	SP	4 8 10 10	18	HNμ = 0 ppm Exp. - ok
2-4'	08-SB-02	1	Yes		Yes	18	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Dry, Fill Material, Mottled Tan and Gray, No Odor Sampled Volatiles and Duplicate (D4)	SP	12 12 17 21	29	HNμ = 0 ppm Exp. - ok
						24	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Dense, Slightly Moist, No Fines, No Odor, Fill Material, Mottled Tan and Gray	SP	12 7 23 23	30	HNμ = 0 ppm Exp. - ok
						22	Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Slightly Damp, No Fines, No Organics or Slit, No Odor, Bottom 6" Wet	SP	15 12 11 10	23	HNμ = 0 ppm Exp. - ok
8-10'	08-SB-02	2	Yes		Yes	24	Fine Sand, 10 YR 3/3 Dark Brown, Loose, Damp, No Odor, w/ Roots, Sampled All Parameters (8-10')	SP	1 2 3 4	5	HNμ = 0 ppm Exp. - ok
						24	Fine Sand, 10 YR 3/3 Dark Brown, Loose, w/ Roots, As Above	SP	2 4 4 5	8	HNμ = 0 ppm Exp. - ok
							EOB - 12' BLS DTW - 11' BLS Sample Summary 08-SB-02 (0-2) 12:22 pm TPH, PAH, P.P. Metals/Duplicate (D4) 08-SB-02 (2-4') 12:25 Volatiles / Duplicate D4 08-SB-02 (8-10') 12:37 pm All Parameters				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 11' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-29-90

Client/Project: Georgia Air National Guard BORING/WELL No. 08-SB-03

Installation: Savannah Site No. 8

HAZWRAP Contractor: CH2M HILL Project No. SEF27794.C0.02

Logged by: R. Olson Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe Drilling Start: 2:50 pm Drilling End: 3:30 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	08-SB-03	1	Yes		Yes	18"	Fine Sand, 10 YR 5/1 Gray, Medium Dense,w/ Surface Organics, Dry, Sampled All Parameters (0-2')	SP	3 5 7 14	12	HNμ = 0 ppm Exp. - ok
						18"	Fine Sand, 10 YR 3/3 Dark Brown, Medium Dense, Moist, Clean, No Odor, HNμ Response	SP	7 5 7 8	12	HNμ = 2 ppm Exp. - ok
4-6'	08-SB-03	2	Yes		Yes	24"	Fine Sand, 10 YR 2/2 Very Dark Brown, Medium Dense, Wet Below 5', Slight Odor, HNμ Detection, Sampled All Parameters (4-6')	SP	3 4 7 8	11	HNμ = 10 ppm Exp. - ok
						24"	Medium Sand, 10 YR 5/4 Yellowish Brown, Very Dense, Saturated, Poorly Graded, Slight Odor and HNμ Response	SP	10 45 29 42	74	HNμ = 4 ppm Exp. - ok
							EOB - 8' BLS DTW - 6.5' BLS Sample Summary 08-SB-03 (0-2) 2:52 08-SB-03 (4-6') 3:07				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 6.5' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-27-90

Client/Project: Georgia Air National Guard BORING/WELL No. 09-SB-01

Installation: Savannah Site No. 9

HAZWRAP Contractor: CH2M HILL Project No. SEF27794.C0.02

Logged by: R. Olson Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe Drilling Start 12:50 pm Drilling End: 1:10 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	09-SB-01	1	Yes		Yes	12"	Silty Fine Sand, Medium Dense, Very Dry, Brittle with Surface Organics, Possibly Fill Material / Sand w/ Clay, 2.5 YR 6/3.5 Light Reddish Brown, Very Dense, Slightly Moist, Virgin Material - Sampled for Lab & Field GC	SM / SC	10 15 12 11	27	HNμ = 0 ppm
						24"		SC	15 15 18 16	33	HNμ = 1 ppm
						12"	Medium Sand with Slight Trace of Clay, 10 YR 6/4 Light Yellowish Brown, Medium/Dense to Dense, Moist to Saturated, No Odor, Slightly Less Clay with Depth Sampled for Lab & Field GC	SP	11 15 18 24	33	HNμ = 1 ppm
6-8'	09-SB-01	2	Yes		Yes	24"		SP	15 11 14 14	25	HNμ = 0 ppm
							EOB - 8' BLS WL - 6' BLS Samples 09-SB-01 (0-2)1:50 09-SB-01 (6-8) 1:06				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 6' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

Date: 06-27-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 09-SB-02
Installation: Savannah
Site No. 9
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I.
Driller: L. Blodsoe
Drilling Start: 1:25 pm
Drilling End: 1:50 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspac_ hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS	
0 - 2'	09-SB-02	1	Yes		Yes	18"	Fine Sand w/ Silt, 7.5 YR 3/2 Dark Brown, Dense, Dry, with Surface Organics, Sampled for Lab & Field GC (0-2') Fine Sand, 10 YR 3/2 Gray, Medium Dense, Clean	SP	12 17 16 6	33	HNμ = 0	2
						12"	Fine Sand with Trace of Clay, 2.5 YR 6/3.5 Light Reddish Brown, Stiff, Dry, No Odor, Mottled Tan And Orange	SC	4 6 10 7	16	HNμ = 0	4
2 - 6'	09-SB-02	2	Yes		No	8"	Fine Sand w/ Trace of Clay, 2.5 YR 6/3.5 Light Reddish Brown, Very Stiff, Moist, No Odor, Slightly Plastic, Sampled for MS/MSD everything except volatile (4-6')	SC	10 10 14 10	24	HNμ = 0	6
8-10'	09-SB-02	2	Yes		Yes	24"	Fine Sand, 10 YR 6/4 Light Yellowish Brown, Loose, Saturated, Sampled for Volatiles, No Odor Water Stabalized at 6.5' lbs	SP	6 4 2 2	6	HNμ = 0 ppm	Water Level 6.5' bls 8
							EOB - 8' BLS WL - 6.5' BLS Sample Summary 09-SB-02 (0-2)1:35 MS/MSD 09-SB-02 (4-6) TPH, PAH, Metals 09-SB-02 (6-8) Volatiles					10 12 14

U = Thin wall tube
R = Rock coring N/A
Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube)
O = Other N/A
G/C Oper.: S. Holzgen

C = Cuttings
Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-27-90

Client/Project: Georgia Air National Guard | BORING/WELL No. 09-SB-03

Installation: Savannah | Site No. 9

HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0.02

Logged by: R. Olson | Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe | Drilling Start: 2:45 pm Drilling End: 3:15 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 | Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	09-SB-03	1	Yes		Yes	18"	Silty Fine Sand, 10 YR 4/1 Dark Gray, Dense, Dry, Possibly Fill Material, Sampled for Lab & Field GC (0-2')	SP	6 20 18 15	38	HNμ = 0 ppm
						15"	Fine Sand, 10 YR 3/3 Dark Brown, Medium Dense, Dry, Mottled Gray and Dark Brown, Possibly Fill Material, No Odor	SP	14 12 8 8	20	HNμ = 0 ppm
4-6'	09-SB-03	2	Yes		Yes	12"	Clayey - Fine Sand, 2.5 YR 6/3.5 Light Reddish Brown, Very Stiff, Slightly Moist, Sample TPH and PAH Metals (Collected Duplicate D-2)	SC	12 14 14 11	28	HNμ = 0 ppm
6-8'	09-SB-03	2	Yes		Yes	24"	Coarse Sand, Medium Dense, Saturated, No Fines, No Odor, Sample for Volatiles 6-8' (Collected Duplicate D-2)	SP	4 4 8 10	12	HNμ = 0 ppm
							EOB - 8' BLS WL - 7' BLS Sample Summary 09-SB-03 (0-2) All Parameters 09-SB-03 (4-6) / D-2 TPH, PAH, P.P. Metals 09-SB-03 (6-8) / D-2 Volatiles				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 7' bls

U = Thin wall tube | R = Rock coring N/A | Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) | O = Other N/A | G/C Oper.: S. Holzgen

C = Cuttings | Notes:

SOIL BORING LOG

Date: 06-27-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-SB-04

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: L. Blodsoe — Drilling Start: 3:40 pm Drilling End: 3:50 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS	
0-2	09-SB-04	1	No		No	24"	Fine Sand, 10 YR 4/1 Dark Gray, Medium Dense, Sightly Damp Sampled for Lab & Field GC	SP	8 7 10	17	HNμ = 0 ppm	
							Sandy Clay, 2.5 YR 6/4 Light Reddish Brown, Dry, Cemented	SC	11			2
						24"	Fine Sand, 10 YR 4/1 Dark Gray, Loose, Strong Odor, Saturated w/ Product Below 3.5'	SP	4 3 4 4	7	HNμ = 0 ppm HNμ = 50+ ppm	4
						24"	Fine Sand, 2.5 Y 2/0 Black, Loose, Damp, Strong Product Odor, Visible Staining Abandoned Borehole 6'	SP	3 5 5 5	10	HNμ = 50+ ppm	6
							EOB - 6' BLS Abandoned Boring Gross Contamination Did Not Analyze Samples					8 10 12 14

U = Thin wall tube — R = Rock coring N/A — Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) — O = Other N/A — G/C Oper.: S. Holzgen

C = Cuttings — Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-27-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-SB-05

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe — Drilling Start: 4:05 pm Drilling End: 4:28 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS	Depth scale
0-2'	09-SB-05	1	Yes		Yes	18"	Fine Sand, 2.5 YR 6/2 Light Brownish Gray, Dense, Dry, No Odor, Sampled for Lab & Field GC	SP	4 18 18 11	36	HNµ = 0 ppm	2
						18"		SP / SC	4 4 6 6	10	HNµ = 0 ppm	4
						18"	Clayey Sand, 2.5 Y 6/2 Light Brownish Gray, Very Stiff, Slightly Moist	SC	10 9 9 9	18	HNµ = 0 ppm	6
6-8'	09-SB-05	2	Yes		Yes	20"	Clayey Sand, 2.5 Y 7/0 Light Gray, Very Stiff, Saturated, Slightly Plastic, No Odor, Sampled All Parameters (6-8')	SC	8 8 9 9	17	HNµ = 0 ppm	Water Level 7' bls; 8
							EOB - 8' BLS WL - 7' BLS Sampled 09-SB-05 (0-2) 4:06 09-SB-05 (6-8) 4:18					10, 12, 14

U = Thin wall tube — R = Rock coring N/A — Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) — O = Other N/A — G/C Oper.: S. Holzgen

C = Cuttings — Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-29-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 10-SB-01

Installation: Savannah
Site No. 10

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe
Drilling Start: 8:50 am Drilling End: 9:55 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	10-SB-01	1	YES		YES	18"	Fine Sand, 2.5 Y 3/0 Very Dark Gray, Medium Dense, Slightly Moist, Fill Material, Slight Odor Sampled for All Parameters (0-2' bls)	SP	7 7 6 10	13	HNμ = 2 ppm
						18"	Fine Sand and Construction Debris, 2.5 Y 3/2 Very Dark Grayish Brown, Medium Dense, Dry, No Odor	SP	8 7 6 30	13	HNμ = ~ 0 +ppm
						12"	Fine Sand w/ Debris, 10 YR 5/1 Mottled Tan Gray Black, Medium Dense, Dry, Fill Material, Construction Debris Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Original Material	SP	20 12 8 12	N/A	HNμ = 0 +ppm
						18"	Fine Sand, 10 YR 5/4 Yellowish Brown, Loose, Slightly Moist No Odor - Slight HNμ Response Fine Sand, 5 YR 3/2 Dark Reddish Brown, Loose, Slightly Moist, Top of Hard Pan, Brittle	SP	3 3 6 8	9	HNμ = 2 ppm
						24"	Cemented Fine Sand, 2.5 YR 2.5/3 Dark Reddish Brown, Very Dense, Moist, Augered to 9', Hard Pan Did Not Sample as Above,	SP	50/4"		HNμ = 0 +ppm
10-11'	10-SB-01	2	YES		YES	6"	CementedFine Sand, 10 YR 5/2 Grayish Brown, Very Dense, Moist, Sampled 10 - 11' bls, All Parameters No - Duplicate Drilled to 12' to Locate Water	SP	45 50/4"		HNμ = 0 ppm
							EOB - 12' BLS WL - 10' 7" BLS Sample Summary 10-SB-01 (0-2') 8:52 10-SB-01 (10-11') 9:35				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 10.7' bls

U = Thin wall tube   R = Rock coring N/A   Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube)   O = Other N/A   G/C Oper.: S. Holzgen

C = Cuttings   Notes:

SOIL BORING LOG

Date: 06-28-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 11-SB-01

Installation: Savannah — Site No. 11

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: L. Blodsoe — Drilling Start: 3:12 pm Drilling End: 4:00 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_hdsp ( )	Recovery (IN.)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'	11-SB-01	1	Yes		Yes	18"	Fine Sand, 2.5 Y 6/2 Light Brownish Gray, Loose, Dry, Sampled for Volatiles 3:13 (0-2')	SP	2 4 6 7	10	HNµ = 0 ppm
2-4'	11-SB-01	1	Yes		No	15"	Fine Sand, 2.5 Y 6/2 Light Brownish Gray, Loose, Dry, Sampled for TPH, PAH, P.P. Metals MS/MSD / Fine Sand,7.5 YR 5/3 Brown, Medium Dense, Dry, No Fines, Fuel Odor (3'-5' bls)	SP	4 3 4 4	7	HNµ = 50 ppm
						24"	Fine Sand,10 YR 5/3 Dark Brown, Medium Dense, Damp, Fuel Odor	SP	6 6 7 5	13	HNµ = 30 ppm; HNµ = 10 ppm
						18"	CementedFine Sand, 5 YR 3/2 Dark Reddish Brown, Very Dense, Hard Pan, Damp, Fuel Odor, HNµ Response	SP	5 35 55/4		HNµ = 3 ppm
8-10'	11-SB-01	2	Yes		Yes	18"	Cemented Fine Sand, 2.5 YR 2.5/3 Dark Reddish Brown More Reddish w/ Depth, Very Dense, Wet, Hard Pan, Fuel Odor, Sampled All Parameters	SP	50/4"		HNµ = 1 ppm
							EOB - 10' BLS WL - 9' BLS Sample Summary 11-SB-01 (0-2') Volatiles 11-SB-01 (2-4') TPH, PAH/MS/MSD 11-SB-01 (8-10') All Parameters				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 9' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

SOIL BORING LOG

CH2M HILL

Date: 06-28-90

Client/Project: Georgia Air National Guard | BORING/WELL No. 11-SB-02
Installation: Savannah | Site No. 11
HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0.02
Logged by: R. Olson | Protection Level: D
Drilling Contractor E.E.I. Driller: L. Blodsoe | Drilling Start: 4:15 pm Drilling End: 5:00 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 | Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	Headspace_ hdsp ( )	Recovery (IN.)	Litholigic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'	11-SB-02	1	YES		YES	24"	Fine Sand, 2.5 Y 7/3 Pale Yellow, Medium Dense, Powder Dry, No Odor, Sampled All Parameters (0-2')	SP	3 6 11 14	17	HNμ = 0 ppm
						24"	Fine Sand, 2.5 Y 7/0 Light Gray, Medium Dense, No Fines, Powered Dry, No Odor	SP	8 9 5 6	14	HNμ = 0 ppm
						18"	Fine Sand, 5 YR 3/2 Dark Reddish Brown, Very Dense, Increasing Moisture w/Depth, No Odor, Met Refusal at 5.5 lbs/Augered to 6' bls	SP	8 18 45 50/3"	63	HNμ = 0 ppm
						3"	Cemented Fine Sand, 5 YR 3/2 DarkReddish Brown,, Very Dense, Increasing Moisture w/Depth, Met Refusal at 6.5' bls	SP	50/3"		HNμ = 0 ppm
						6"	Cemented Fine Sand, 5 YR 3/2 DarkReddish Brown, Very Dense, Increasing Moisture w/Depth, No Odor Met Refusal at 8.5' bls, Hardpan	SP	50/4"		HNμ = 0 ppm
10-12'	11-SB-02	2	YES		YES	24"	Cemented Fine Sand, 10 YR 5/6 Yellowish Brown, Very Dense, Saturated, No Fines, No Odor, Sampled all parameters and Duplicate (D#)	SP	20 25 35 40	60	HNμ = 0 ppm
							EOB - 12' BLS WL - 9' BLS Sample Summary 11-SB-02 (0-2') 4:17 11-SB-02 (10-12'/D3) 4:50				

Depth scale: 2, 4, 6, 8, 10, 12, 14

Water Level 9' bls

U = Thin wall tube R = Rock coring N/A Field G/C (Make/Mod.) Photo Vac 10-S-50

S = Split spoon (tube) O = Other N/A G/C Oper.: S. Holzgen

C = Cuttings Notes:

Well Boring Logs

WELL BORING LOG

Date: 08-29-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 01-WB-01

Installation: Savannah — Site No. 1 - Wash Rack

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner — Drilling Start: 4:00 pm Drilling End: 4:23 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (In.)	Lithologic Description	USCS	Blows / 6 inch.	N-Value	COMMENTS
0-2'			No			18"	Poorly Graded Fine Sand, 10 YR 6/3 Pale Brown to10 YR 3/3 Dark Brown, Loose, Clean, Surface Organics, No Odor, Possibly Fill material	SP	2 2 5 5	7	HNμ = 0 ppm No Odor
2-4'			No			12"	Poorly Graded Fine Sand, 10 YR 5.5/3 Brown to Pale Brown, Loose, Slightly Damp, Fine Sand, Poorly Graded, No Odor, Possibly Fill material	SP	4 4 2 5	6	HNμ = 0 ppm
4-6'			No			24"	Poorly Graded Fine Sand with organics (rotting), 10 YR 2/2 Very Dark Brown, Medium Dense, Saturated, Strong Organic Odor	SP	7 8 8 5	16	HNμ = 0 ppm Organic Odor
6-8'			No			24"	Poorly Graded Fine Sand, 10 YR 4.5/1 Gray to Dark Gray, Medium Dense, Saturated, No Odor, No Clay	SP	4 6 5 3	11	HNμ = 0 ppm No Odor
8-10'			No			24"		CL CL	2 4 6 7	10	HNμ = 0 ppm Septic Odor Wet
10-12'			No			24"	Sandy-Lean Clay, 10 YR 6.5/1 Light Gray to Gray, Stiff, Saturated, No Odor, (possible sewer leak?)	CL	5 5 10 10	15	HNμ = 0 ppm No Odor
12-14'			No			24"	Poorly Graded Fine Sand, 10 YR 6.5/2 Light Brownish Gray, Medium Dense, Wet, Poorly Graded - Subangular, No Odor	SP	3 8 8 8	16	HNμ = 0 ppm No Odor
							Set Screen 3-13' EOB — 14' b/s DTW — 5' b/s				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16 — Water Level (at approx. 5 ft)

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

CH2M HILL

Date: 08-29-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 01-WB-02

Installation: Savannah
Site No. 1 - Discharge Area

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner
Drilling Start: 9:40 am Drilling End: 10:02 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Lab Anal. (Y/N)	Recovery (In.)	Litholigic Description	USCS	Blows / 6 inch.	N-Value	COMMENTS
0-2	No	8	Poorly Graded Fine to Very Fine Sand, 2.5 YR 2.5/0 Black, Loose, Slightly Moist Poorly Graded, with Surface Organics	SP	2 2 5 4	7	HNµ = 0 ppm No Odor
2-4	No	18"	Poorly Graded Fine to Very Fine Sand, 2.5 YR 2.5/0 Black, Loose, Slightly Damp, No Odor	SP	2 2 3 6	5	HNµ = 0 ppm No Odor
4-6	No	0"	No Recovery — Based on Auger Cuttings Material appears similar to that above	UK	6 5 4 4	9	HNµ = 0 ppm No Odor
6-8	No	24"	Poorly Graded Very Fine Sand with Trace of Clay, 5 Y 6/2 Light Olive Gray, Medium Dense, Saturated, No Odor	SP	4 5 6 7	11	HNµ = 0 ppm No Odor
8-10	No	24"	Poorly Graded Fine with Clay, 5Y 6/1 Gray, Medium Dense, Sample Saturated - Dripping, More Clay Content Than Above, Very Fine Sand Slightly PLastic	SI SC	4 5 6 8	11	HNµ = 0 ppm No Odor
10-12	No	24"	Clayey Sand, Marbled 5Y 6/1 Gray to 7.5 YR 5/8 Strong Brown, Stiff, Moist/Wet, Slightly Plastic	SP CL	6 8 10 12	18	HNµ = 0 ppm No Odor
12-14	No	24"	Poorly Graded Fine Sand, 10 YR 7/2 Light Gray, Loose, Saturated, No fines, No Odor	SP	5 3 3 2	6	HNµ = 0 ppm No Odor
			EOB - 14' BLS DTW - 5.5' BLS				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

CH2M HILL

Date: 08-29-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 01-WB-03

Installation: Savannah — Site No. 1 - Discharge Area

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner — Drilling Start: 2:30 pm Drilling End: 3:02 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Lithologic Description	USCS	Blows / 6 inch.	N-Value	COMMENTS
0-2			No			12"	Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Loose Moist, with Trace of Silt and Surface Organics	SP	3 4 4 3	8	HNμ = 0 ppm No Odor
2-4			No			24"	Clayey Sand, 5Y 6/1 Gray to 7.5 YR 5/8 Strong Brown, Soft, Slightly Plastic, No Odor	SP / SC	4 2 3 2	5	HNμ = 0 ppm No Odor
4-6			No			18"	Sandy Lean Clay, 5 Y 4/2 Olive Gray, Medium, Stiff, Wet, Low Plasticity - Very Fine Sand Sized, No Odor	CL	2 3 4 4	7	HNμ = 0 ppm No Odor
6-8			No			18"	Sandy Lean Clay with lenses of Fine Sand, 5Y 6/1 Gray, Stiff, Slightly Damp, Slightly More Sand Than Above with More Blue color - Low Plasticity, No Odor, No Excess, Some Sand Lenses	CL	4 5 6 8	11	HNμ = 0 ppm No Odor
8-10			No			24"	Sandy Lean Clay, 5Y 6/2 Light Olive Gray to 10 YR 7/8 Yellow, Very Stiff, Damp, No Odor, with Lenses of Sand, Low Plasticity	CL	7 8 9 8	17	HNμ = 0 ppm No Odor
10-12			No			18"	Sandy Lean Clay, 5Y 6/2 Light Olive Gray to 10 YR 7/8 Yellow, Very Stiff, Damp, No Odor, Low Plasticity	CL	7 8 11 12	19	HNμ = 0 ppm No Odor
							EOB - 12' BLS DTW - 4' BLS				

Depth scale: 2, 4 (Water Level), 6, 8, 10, 12, 14, 16

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

Date: 08-31-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 02-WB-01

Installation: Savannah
Site No. 2

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner
Drilling Start: 8:10 am Drilling End: 8:42 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Lithologic Description	USCS	Blows / 6 inch.	N-Value	COMMENTS
0-2'			No			18"	Poorly Graded Fine Sand, 2.5 Y 3/2 Very Dark Grayish Brown, Loose, Dry, No Odor, Some Surface Organics	SP	2 3 2 2	5	HNμ = 0 ppm O_2 - OK
2-4'			No			18"	Poorly Graded Sand with Clay, 10YR 4.5/6 Dark Yellowish Brown, Medium, Slightly Moist, No Odor	SP SC	2 3 3 3	6	HNμ = 0 ppm O_2 - OK
4-6'			No			19"	Sandy Lean Clay, 10 YR 5/6 Dark Yellowish Brown, Stiff, Moist, No Odor, Non-Plastic, As Above (4-6') with Slightly More Clay and More Orange	SP CL	3 6 6 5	12	HNμ = 0 ppm O_2 - OK
6-8'			No			22"	Sandy Lean Clay, 5 Y 6/2 Light Olive Gray, Very Stiff, Saturated, No Odor, Slightly Plastic	CL	6 9 9 7	18	HNμ = 0 ppm O_2 - OK
8-10'			No			24"	Poorly Graded Very Fine Sand, 5 Y 5/2 Olive Gray, Medium Dense, Saturated, Trace of Silt and Clay, No Odor	SP	4 5 8 8	13	HNμ = 0 ppm O_2 - OK
10-12'			No			24"	Poorly Graded Sand, 5 Y 5/2 Olive Gray, Medium Dense, Saturated, Good Water Zone, No Odor / Sandy Lean Clay, 5 Y 5/2 Olive Gray, Stiff, Very Fine Sand, No Odor	SP / CL	5 5 5 7	10	HNμ = 0 ppm O_2 - OK
12-14'			No			24"	Sample - Not Representative	UK	5 4 6 9	10	HNμ = 0 ppm O_2 - OK
							EOB - 14' b/s DTW - 6' b/s				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level (at 6)

U = Thin wall tube R = Rock coring ____ Field G/C (Make/Mod.) ____

S = Split spoon (tube) O = Other ____ G/C Oper.: ____

C = Cuttings Notes: ____

WELL BORING LOG

CH2M HILL

Date: 09-9-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 05-WB-01

Installation: Savannah — Site No. 5 - POL

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: G. Bray — Drilling Start: 4:12 pm Drilling End: 4:46 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Lithologic Description	USCS	Blows / 6 Inch.	N-Value	COMMENTS	
0-2'			No			18"	Surface Organics Poorly Graded Fine Sand, 10 YR 4/1 Dark Gray, Medium Dense, Dry, Fill Material	SP	4 5 6 8	11	HNμ = 0 ppm No Odor	2
2-4'			No			18"	 Clayey Fine Sand, 10 YR 6/2 Light Brownish Gray and 10 YR 5/6 Yellowish Brown, Medium, Saturated/Moist, Mottled	SP SC	4 2 4 4	6	HNμ = 0 ppm No Odor	Water Level 4
4-6'			No			24"	LeanClay with Sand, 10 YR 6/2 Light Brownish Gray and 10 YR 5/6 Yellowish Brown, Stiff, Wet, Slightly Plastic, Mottled, No Odor	SP	4 6 6 8	12	HNμ = 0 ppm No Odor	6
6-8'			No			24"	Poorly Graded Sand with clay, 10 YR 6/2 Light Brownish Gray and 10 YR 5/6 Yellowish Brown, Medium Dense, Saturated	SC SP	7 9 10 10	19	HNμ = 0 ppm No Odor	8
8-10'			No			24"	Clayey Medium Fine Sand, 2.5 YR 6/3 Light Yellowish Brown, Loose, Saturated, Plastic, No Odor,	SW-CL	3 4 3 5	7	HNμ = 2 ppm No Odor	10
10-12'			No			16"	Clayey Sand, 5 Y 5/1 Gray, Soft, Saturated, Plastic, Well Graded, No Odor	SC	3 2 2 2	4	HNμ = 1 ppm No Odor	12
							No Recovery		1 1 1 1	2	HNμ = UK	14
							No Recovery		3 3 3 1	6	HNμ = UK	16
							EOB - 16' b/s DTW-3' b/s Drummed Cuttings					

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

Date: 09-9-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 05-WB-02
Installation: Savannah
Site No. 5 - POL
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I. Driller: G. Bray
Drilling Start: 10:27 am Drilling End: 11:26 am
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Litholigic Description	USCS	Blows / 6 inch.	N-Value	COMMENTS
0-2'			No			20"	Surface Organics Poorly Graded Sand with Silt, 10 YR 3/1 Very Dark Gray, Loose Clayey Sand, 7.5 YR 4/6 Strong Brown, Loose, Moist	SP SC	3 4 5 7	9	HNμ = 0 ppm No Odor
2-4'			No			18"	Clayey Sand, 7.5 YR 5/6 Strong Brown, Loose, Moist, Non-Plastic, No Odor	SC	6 7 9 9	16	HNμ = 0 ppm No Odor
4-6'			No			18"	Poorly Graded Fine Sand, 10 YR 6/2 Light Brownish Gray and 7.5 YR 6/6, Reddish Yellow, Medium Dense, Wet/Saturated, No Odor	SP	8 8 6 5	14	HNμ = 0 ppm No Odor
6-8'			No			24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray and 7.5 YR 5/6 Strong Brown, Loose, Saturated, Non-Plastic	SC	4 4 3 4	7	HNμ = 0 ppm No Odor
8-10'			No			24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray, Loose, Saturated, Non-Plastic	SC	3 2 3 5	5	HNμ = 5 ppm No Odor
10-12'			No			24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray, Medium Dense, Saturated Poorly Graded Fine Sand, 10 YR 6/2 Light Brownish Gray, Medium Dense, Saturated	SC SP	5 6 6 6	12	HNμ = 0 ppm No Odor
12-14'			No			24"	Clayey Sand with Trace of Clay (15%), 10 YR 6/6 Brownish Yellow, Soft, Saturated Poorly Graded Fine Sand, 5 Y 4/1 Dark Gray, Very Loose, Saturated, No fines, Fuel Odor	SC SP	2 2 1 2	3	HNμ = 3 ppm Fuel Odor
							EOB - 14' b/s DTW-5' b/s Drummed Cuttings				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level (at approx. 5')

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

(S) Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

CH2M HILL

Date: 09-9-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 05-WB-03
Installation: Savannah
Site No. 5 - POL
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I. Driller: G. Bray
Drilling Start: 2:12 pm Drilling End: 2:31 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Lithologic Description	USCS	Blows / 6 Inch.	N-Value	COMMENTS
0-2'			No			24"	Surface Organics Well Graded Fine Sand, 10 YR 3/1 Very Dark Gray, Loose, Dry, Fill Poorly Graded Fine Sand, 10 YR 6/5 Brownish Yellow, Medium Dense, Dry	SW SP	2 3 7 8	10	HNμ = 0 ppm No Odor
2-4'			No			22"	Poorly Graded Sand w/ Clay, 10 YR 6/2 Light Brownish Gray and 7.5 YR 5/6 Strong Brown, Medium Dense, Slightly Damp, Marbled Colors	SP SC	10 10 10 12	20	HNμ = 0 ppm No Odor
4-6'			No			24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray and 10 YR 5/6 Yellowish Brown, Wet Below 5', Poorly Graded, Medium Grained Fine Sand, Medium Dense	SC	14 10 8 7	18	HNμ = 0 ppm No Odor
6-8'			No			18"	Sandy Lean Clay, 10 YR 6/2 Light Brownish Gray, Stiff, Saturated, Slightly Plastic	CL	8 7 9 10	16	HNμ = 0 ppm No Odor
8-10'			No			18"	Sandy Lean Clay, 10 YR 5.5/3.5 Light Yellowish Brown, Medium Stiff to Stiff, Saturated, Slightly Plastic	SP CL	7 5 4 4	9	HNμ = 0 ppm No Odor
10-12'			No			18"	Poorly Graded Fine Sand, 2.5 Y 6/3 Light Yellowish Brown, Loose, Saturated	SP	2 3 3 4	6	HNμ = 0+ ppm No Odor
12-14'			No			24"	Poorly Graded Fine Sand, 2.5 Y 6/3 Light Yellowish Brown, Loose, Saturated	SP	2 3 5 3	N/A	HNμ = 1.5 ppm No Odor
							EOB - 14' b/s DTW - 5' b/s Drummed Cuttings				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level (at 5')

U = Thin wall tube R = Rock coring Field G/C (Make/Mod.)

S = Split spoon (tube) O = Other G/C Oper.:

C = Cuttings Notes:

WELL BORING LOG

CH2M HILL

Date: 09-10-90

Client/Project: Georgia Air National Guard BORING/WELL No. 05-WB-04

Installation: Savannah Site No. 5

HAZWRAP Contractor: CH2M HILL Project No. SEF27794.C0.02

Logged by: R. Olson Protection Level: D

Drilling Contractor E.E.I. Driller: G. Bray Drilling Start: 9:01 am Drilling End: 9:23 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (In.)	Lithologic Description	USCS	Blows / 6 inch	N-Value	COMMENTS
0-2'			No			12"	Fine Sand with Surface Organics, 7.5 YR 3/0 Very Dark Gray Poorly Graded Fine Sand with Silt, 10 YR 5/2.5 Grayish Brown, Medium Dense, Dry	SP SP	7 6 8 9	14	HNµ = 0 ppm Pine Root Odor
2-4'			No			20"	Poorly Graded Fine Sand with Silt, 10 YR 6/2 Light Brown Gray and 10 YR 5/6, Yellowish Brown, Medium Dense, Dry, Mottled, No Odor	SP SM	12 11 11 10	22	HNµ = 0 ppm No Odor
4-6'			No			24"	Clayey Sand, 10 YR 6/2 Light Brownish Gray and 10 YR 5/4 Yellowish Brown, Slightly Moist, Medium Dense, No Odor	SC	6 10 10 8	20	HNµ = 4 ppm No Odor
6-8'			No			14"	Poorly Graded Sand with Clay, 10 YR 6/2 Light Brownish Gray and 10 YR 6/4 Light Yellowish Brown, Medium Dense, Moist (just above water line), Non-Plastic	SP SC	8 9 11 9	20	HNµ = 5 ppm No Odor
8-10'			No			18"	Well Graded Fine Sand, 10 YR 6/2 Light Grayish Brown, Medium Dense, Saturated, No Fines, No Odor	SW	7 7 8 7	15	HNµ = 5 ppm No Odor
10-12'			No			20"	Well Graded Fine Sand with Clay, 10 YR 6/2 Light Grayish Brown, Loose to Medium Dense, Saturated, No Odor, Non-Plastic	SW SC	6 5 5 5	10	HNµ = 4 ppm No Odor
12-14'			No				Well Graded Fine Sand with Trace (5%) Clay, 10 YR 6/2 Light Grayish Brown, Loose, Saturated, Non-Plastic	SW	4 4 5 5	9	HNµ = 13 ppm No Odor
							EOB - 14' BLS DTW-8' BLS Drummed Cuttings				

Depth scale: 2, 4, 6, 8 (Water Level), 10, 12, 14, 16

U = Thin wall tube R = Rock coring Field G/C (Make/Mod.)

S = Split spoon (tube) O = Other G/C Oper.:

C = Cuttings Notes:

SOIL BORING LOG

Date: 08-31-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 06-WB-01
Installation: Savannah
Site No. 6
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I. Driller: S. Turner
Drilling Start: 11:00 am Drilling End: 11:45 am
Drilling Method/Rig Type: Pot Hole Diggers
Borehole Dia(s): 8"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Litholigic Description	USCS	Blows / 6 Inch	N-Value	COMMENTS
0-1						N/A	Sandy Organic Soil, 5 YR 2.5/1 Black, Loose, Moist, Compost	OL	OK	OK	HNμ = 0 ppm No Odor
1-3						N/A	Poorly Graded Fine Sand, 5 YR 2.5/1 Black, Moist, with Trace of Silt and Organics, Saturated, Loose, No Odor	SP	OK	OK	HNμ = 0 ppm No Odor
3-5						N/A	Poorly Graded Medium Sand, 5 YR 4.5/1.5 Dark Reddish Gray, Saturated, No Odor, Highly Permeable, Sub-Angular	SP	OK	OK	HNμ = 0 ppm No Odor
							EOB - 5' BLS DTW - 2.5' BLS				

Depth scale: 2 (Water Level), 4, 6, 8, 10, 12, 14, 16

U = Thin wall tube R = Rock coring
Field G/C (Make/Mod.)
S = Split spoon (tube) O = Other Post Hole
G/C Oper.:
C = Cuttings Notes:

SOIL BORING LOG

Date: 08-30-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 07-WB-01

Installation: Savannah — Site No. 7 - Wash Rack

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner — Drilling Start: 8:45 am Drilling End: 9:02 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in.)	Lithologic Description	USCS	Blows / 6 Inch.	N-Value	COMMENTS
0-2'			No				Poorly Graded Fine Sand, 10 YR 3/1 Very Dark Gray, Loose, Damp, No Odor, some Surface Organics Post Holed to Check for Utilities - No Blow Values	SP	N/A	N/A	HNμ = 0 ppm No Odor
2-4'			No				Poorly Graded Fine Sand, 10 YR 4/2 Dark Grayish Brown, Medium Dense, Moist, Slight Fuel Odor	SP	8 8 7 9	15	HNμ = 2 ppm at 3'
4-6'			No				Lean Clay with Sand, 10 YR 4/1 Dark Gray, Stiff, Wet, No Odor, Low Plasticity	CL	7 5 5 6	10	HNμ = 0 ppm No Odor
6-8'			No				Poorly Graded Fine Sand with Clay, Medium Dense, Saturated, 10 YR 4/1 Dark Gray, Not as Much Clay as Above, Slight Fuel Odor	SP SC	8 10 13 19	23	HNμ = 2 ppm Slight Odor
8-10'			No				Poorly Graded Medium Sand, 10 YR 7/1 Light Gray, Dense, Saturated, Sub Angular - Highly Permeable, Very few fines	SP	14 20 18 21	38	HNμ = 0 ppm No Odor
							EOB - 10' BLS DTW - 3' BLS Drummed Boring Cuttings				

Depth scale: 2 4 6 8 10 12 14 16 — Water Level (at 3')

U = Thin wall tube R = Rock coring Field G/C (Make/Mod.)

S = Split spoon (tube) O = Other G/C Oper.:

C = Cuttings Notes:

WELL BORING LOG

Date: 09-10-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 08-WB-01

Installation: Savannah — Site No. 8

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: G. Bray — Drilling Start: 5:42 pm Drilling End: 6:20 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	N-Valve	COMMENTS
0-2'			No			18"	Poorly Graded Fine Sand, 10 YR 3/2 Dark Grayish Brown, Loose, Dry, with Surface Organics, Fill Material Poorly Graded Fine Sand, 7.5 YR 2.5/0 Very Dark Gray, Medium Dense, Moist, Fill Material	SP	4 3 7 7	10	HNμ = 0+ ppm No Odor
2-4'			No			24"	Poorly Graded Fine Sand, 7.5 YR 3/2 Dark Brown, Medium Dense, Slightly Damp, No Odor	SP	7 6 7 7	13	HNμ = 6 ppm No Odor
4-6'			No			10"	Poorly Graded Fine Sand, 10 YR 5/3 Brown, Medium Dense, Saturated, No Odor Poorly Graded Fine Sand, 10 YR 3/1 Very Dark Gray, Medium Dense, Saturated, No Odor	SP SP	9 8 8 11	16	HNμ = 1 ppm No Odor
6-8'			No			18"	Poorly Graded Fine Sand with Silt, 5 YR 2.5/1 Very Dark Gray to Black, Dense to Medium Dense, Saturated Sandy Lean Clay, 5 YR 3/1 Very Dark Gray, Very Stiff, Slightly Plastic, Saturated, Strong Odor	SP SC	16 12 16 7	28	HNμ = 15 ppm Fuel Odor
8-10'			No			18"	Sandy Fat Clay, 10 YR 4.5/2 Grayish Brown, Very Stiff, Saturated, Plastic, Wet, Strong Odor	SP CL	8 7 11 13	18	HNμ = 15+ ppm Oily Odor
10-12'			No			12"	Fat Clay with Seams of Sand, 10 YR 3.5/1 Very Dark Gray, Very Stiff, Highly Plastic, low Permeability, Sand Seams have High HNμ Readings	CH	7 10 8 10	18	HNμ = 10+ ppm Oily Odor
12-14'			No			18"	Clayey Sand (5-10% Clay), 10 YR 4/2 Dark Grayish Brown, Medium Dense, Saturated, Strong Odor	SC	8 11 13 22	24	HNμ = 6 ppm Oily Odor
							EOB - 14' BLS DTW - 3.5' BLS Drummed Cuttings				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18 — Water Level (at approx. 3.5')

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

Date: 09-8-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 08-WB-02

Installation: Savannah — Site No. 8

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: G. Bray — Drilling Start: 5:26 pm Drilling End: 6:22 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	N-Valve	COMMENTS
0-2'			No			N/A	Concrete Hard Gray w/ Granite Aggregate				HNμ = 0 ppm No Odor
						12"	Poorly Graded Fine Sand, 10 YR 4/2 Dark Grayish Brown, Dense, Moist, Fill Material	SP	26 30		
2-4'			No			12"	Poorly GradedFine Sand, 10 YR 3/1 Very Dark Gray, Very Dense, Moist, Clean	SP	20 30	N/A	HNμ = 0 ppm No Odor
							Refusal Augered Down to -4'	UK	UK 1		
4-6'			No			22"	Poorly Graded Fine Sand w/ Pine Roots, 10 YR 6/1.5 Light Brownish Gray, Medium Dense, Damp	SP	7 9 12 26	21	HNμ = 0 ppm Pine Odor
6-8'			No			20"	Poorly Graded Fine Sand with Roots, 10 YR 3/1 Very Dark Gray, Dense, Slightly Damp, Pine Odor	SP	17 22 18 15	40	HNμ = 0 ppm Pine Odor
8-10'			No			20"	Fine Sandy Organic Soil with Rotting Organics, 10 YR 3/3 Dark Brown, Medium Dense, Saturated	OL	6 10 9 6	19	HNμ = 0 ppm
10-12'			No			16"	Poorly Graded Fine Sand, 10 YR 6/2 Light Brownish Gray, Medium Dense, Saturated, Very Loose, No Odor	SP	2 1 2 4	3	HNμ = 0 ppm No Odor
12-14'			No			24"	Clayey Sand with Traces of Silt, 10 YR 6/2 Light Brownish Gray, Medium Dense, Saturated, Non-Plastic	SP SC	6 6 6 7	12	HNμ = 0 ppm No Odor
14-16'			No			18"	Clayey Sand w/Traces of Silt, 10 YR 6/2 Light Brownish Gray, Medium Dense, Non-Plastic, Saturated	SC	5 8 7 4	15	HNμ = 0 ppm No Odor
							EOB - 16' BLS DTW - 9' BLS				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16 — Water Level

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

Date: 09-8-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 08-WB-03

Installation: Savannah
Site No. 8

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor: E.E.I. Driller: S. Turner
Drilling Start: 8:45 am Drilling End: 9:05 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 Inch.	N-Value	COMMENTS
0-2'			No			N/A	Poorly Graded Fine Sand, 10 YR 3/1 Very Dark Gray, with Surface Organics, Dry, No Odor, Possibly Fill Matnia Post Holed to Check for Utilities	SP		N/A	HNμ = 0 ppm No Odor
2-4'			No			12"	Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Loose, Moist,	SP / SP	2 2	N/A	HNμ = 0 ppm No Odor
4-6'			No			24"	Poorly Graded Fine Sand, 10 YR 3/3 Dark Brown, Loose to Medium Dense, Moist, No Odor	SP	2 4 5 9	11	HNμ = 0 ppm No Odor
6-8'			No			20"	Silty Fine Sand, 10 YR 2/2 Very Dark Brown, Dense, Moist Poorly Graded Fine Sand, 10 YR 3/2 Very Dark Grayish Brown, Wet, Medium Dense	SP	11 16 11 9	27	HNμ = 0 ppm No Odor
8-10'			No			24"	Poorly Graded Fine Sand, 10 YR 5/2 Grayish Brown, Wet, Loose	SP / SP	4 4 4 5	8	HNμ = 0 ppm No Odor
10-12'			No			24"	Sandy Lean Clay, 10 YR 5/1 Gray, Saturated, Stiff, Slightly Plastic	CL / SP	8 6 6 9	12	HNμ = 0 ppm No Odor
12-14'			No			24"	Poorly Graded Fine Sand, 10 YR 3/3 Dark Brown, Loose to Medium Dense, Saturated, No Odor	SP	4 5 6 6	11	HNμ = 0 ppm No Odor
							EOB - 14' BLS DTW - 9' BLS				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level

U = Thin wall tube R = Rock coring Field G/C (Make/Mod.)

S = Split spoon (tube) O = Other G/C Oper.:

C = Cuttings Notes:

WELL BORING LOG

Date: 09-8-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 08-WB-04

Installation: Savannah — Site No. 8

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D-

Drilling Contractor E.E.I. Driller: G. Bray — Drilling Start: 11:04 am Drilling End: 11:42 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	N-Valve	COMMENTS
0-2'			No			N/A	Poorly Graded Fine Sand, 10 YR 3/1 Very Dark Gray, Loose, Dry, Possibly Fill Material, Post Holed to Check for Utilities	SP	UK	N/A	HNμ = 0 ppm No Odor
2-4'			No			N/A / 12"	Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Loose, Damp, Possibly Fill Material	SP		N/A	HNμ = 0 ppm No Odor
4-6'			No			20"	Poorly Graded Fine Sand, 10 YR 2/1 Black, Medium Dense, Slightly Damp, Partially Cemented (Brittle), No Odor	SP	6 7 6 5	13	HNμ = 0 ppm No Odor
6-8'			No			22"	Sandy Silt with Clay, 10 YR 3/1 Very Dark Gray, Stiff, Saturated, No Odor	ML	4 5 7 10	12	HNμ = 0 ppm No Odor
8-10'			No			24"	Lean Clay with Sand, 10 YR 3/1 Very Dark Gray, Very Stiff, Wet But Not Saturated, Slightly Plastic	CL	12 14 16 19	30	HNμ = 0 ppm No Odor
10-12'			No			24"	Well Graded Sand, 10 YR 6/2 Light Brownish Gray, Dense, Saturated, Subangular, No Odor	SW	12 21 27 32	18	HNμ = 0 ppm No Odor
12-14'			No			18"	Well Graded Sand w/ Len. [illegible] Silty Clay, 10 YR 6/2 Light Brownish Gray, Medium Dense, Saturated	SW/ML	9 6 12 10	18	HNμ = 0 ppm No Odor
							EOB - 14' BLS DTW - 7' BLS				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

CH2M HILL

Date: 09-4-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-WB-01

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. Driller: S. Turner — Drilling Start: 4:15 pm Drilling End: 5:05 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'			No			18"	Poorly Graded Fine Sand, 2.5 Y 5/2 Grayish Brown, Medium Dense, Wet, Possibly Fill Material	SP	4 8 12 12	N/A	HNµ = 0 ppm No Odor
2-4'			No			18"	Poorly Graded Fine Sand, Mottled, 10 YR 6/2 Light Brownish Gray to 10 YR 2/1 Black, Medium Dense, Wet, Possibly Fill Material	SP	7 8 7 9	N/A	HNµ = 0 ppm No Odor
4-6'			No			16"	Poorly Graded Sand with Clay, 5 YR 5/8 Yellowish Red, Medium Dense, Saturated, Non-Plastic, Moderately Low Permeability	SP-SC	8 9 9 10	N/A	HNµ = 0 ppm No Odor
6-8'			No			24"	(continued from above) / Poorly Graded Fine Sand, 10 YR 6.5/1 Light Gray, Medium Dense to Dense, Trace of Clay, Saturated	SP-CL / SP	12 12 18 22	N/A	HNµ = 0 ppm No Odor
8-10'			No			20"	Poorly Graded Sand with Silt / Poorly Graded Fine Sand, Mottled, 2.5 Y 7/2 Light Gray to 10 YR 7/6 Yellow, Loose to Medium Dense, Saturated, Highly Permeable	SP-SM / SP	2 4 6 8	N/A	HNµ = 0 ppm No Odor LEL = 0
10-12'			No			24"	Fine Sandy, 10 YR 7/1 Light Gray, Loose, Saturated, with Lenses of Gray Plastic Clay, Mod. Loose, Primarily SP	SP / CH	2 3 4 8	N/A	HNµ = 0 ppm No Odor LEL = 0
12-14'			No			24"	Fine Sandy, 2.5 Y 7/1 Light Gray, Medium Dense, Saturated, Well Graded, with Lenses of Clay	SW	2 4 7 8	N/A	HNµ = 0 ppm No Odor
							EOB - 14' bls DTW - 4.5 bls				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level (at 4.5 ft)

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

WELL BORING LOG

Date: 09-5-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-WB-02

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. — Driller: S.Turner — Drilling Start: 2:58 pm — Drilling End: 3:30 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	Water Depth	COMMENTS
0-2'			No			20"	Poorly Graded, Fine Sand, 2.5 Y 5/2 Grayish Brown, Medium Dense, Slightly Damp, Mottled, Possibly Fill Material	SP	5 8 9 10	N/A	HNμ = 14 ppm Not Much Odor
2-4'			No			18"	Poorly Graded, Fine Sand, 10 YR 2/1 Black & 10 YR 7/4 Very Pale Brown, Medium Dense, Moist, No Odor	SP	7 10 10 13	N/A	HNμ = 2 ppm No Odor
4-6'			No			14"	Poorly Graded Sand with Clay (~10%), 10 YR 4.5/2 Grayish Brown to Dark Grayish Brown, Saturated	SP-SC	3 3 4 3	N/A	HNμ = 2.5 ppm No Odor
6-8'			No			24"	Poorly Graded Sand with Clay (15%), 5 Y 7/1 Light Gray, Medium Dense, Saturated, Trace of Silt	SP-SC	3 6 6 11	N/A	HNμ = 1 ppm No Odor
8-10'			No			24"	Poorly Graded Fine Sand, 2.5 Y 6.5/2 Light Brownish Gray to Light Gray, Medium Dense, Saturated	SP	3 13 12 8	N/A	HNμ = 2 ppm Slight Fuel Odor
10-12'			No				Poorly Graded Fine Sand, 2.5 Y 6.5/2 Light Brownish Gray to Light Gray, Medium Dense to Dense, Saturated, Highly Permeable	SP	15 16 14 17	N/A	HNμ = 2 ppm Slight Fuel Odor
							EOB - 12' - bls DTW - 4' - bls Drummed cuttings				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level (at 4)

U = Thin wall tube   R = Rock coring ________   Field G/C (Make/Mod.) ________

S = Split spoon (tube)   O = Other ________   G/C Oper.: ________

C = Cuttings   Notes: ________

CH2M HILL

WELL BORING LOG

Date: 09-5-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-WB-03

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner — Drilling Start: 9:13 am Drilling End: 9:51 am

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'			No			18"	Surface Organics Poorly Graded Fine Sand, 10 YR 4/1 Dark Gray, Loose, Damp, Possibly Fill Material,	SP	5 4 5 4	9	HNµ = 0 ppm No Odor
2-4'			No			20"	Poorly Graded Fine Sand, 10 YR 5.5/2 Light Brownish Gray, Loose to Medium Dense, Slightly Damp, Mottled, Color, No Fines, No Odor	SP	5 5 6 4	11	HNµ = 0 ppm No Odor
4-6'			No			18"	Poorly Graded Sand with Clay, 5 Y 5/2 Olive Gray, Loose to Medium, Wet, No Odor Sandy Lean Clay, 7.5 YR 5/6 Strong Brown, Dense, Wet, Slightly More Clay Than Above	SP-SC CL	4 6 10 10	16	HNµ = 0 ppm No Odor
6-8'			No			16"	Poorly Graded Very Fine Sand w/ Trace of Clay & Silt, 2.5 Y 6.5/2 Light Brownish Gray, Medium Dense, Saturated, No Odor	SP	7 8 8 10	16	HNµ = 0 ppm No Odor
8-10'			No			22"	Poorly Graded Fine Sand, 2.5 Y 6.5/2 Light Brownish Gray to 10 YR 6/6 Brownish Yellow, Medium Dense, Saturated, Traces of Silt and Lenses of Plastic Clay	SP	6 7 8 11	15	HNµ = 0 ppm No Odor
10-12'			No			24"	Poorly Graded Fine Sand, 10 YR 7/1 Light Gray, Loose to Medium Dense, Saturated, Clean, Slightly Coarser Than Above	SP	3 5 6 7	11	HNµ = 0 ppm No Odor
12-14'			No			24"	Poorly Graded Fine Sand with Trace of Clay (5%), 10 YR 7/1 Light Gray, Very Loose, Saturated	SP	2 2 4 12	6	HNµ = 0 ppm No Odor
							EOB - 14' bls DTW - 5.5' bls				

Depth scale: 2 4 6 8 10 12 14 16

Water Level

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

CH2M HILL

WELL BORING LOG

Date: 09-4-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 09-WB-04

Installation: Savannah
Site No. 9

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor E.E.I. Driller: S. Turner
Drilling Start: 1:40 pm Drilling End: 2:12 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'			No			20"	Poorly Graded Fine Sand, 2.5 Y 5/2 Grayish Brown, Medium Dense, Slightly Damp, Possibly Fill Material, Surface Organics	SP	3 6 6 8	N/A	HNμ = 0 ppm No Odor O_2 - 20.8%
2-4'			No			17"	Poorly Graded Sand with Clay, 2.5 Y 5/2 Grayish Brown & 5YR 4/6 Yellowish Red, Damp, Non-Plastic, Medium Dense	SP-SC	5 4 6 12	N/A	HNμ = 0 ppm No Odor
4-6'			No			20"	Well Graded Sand with Clay, 5 YR 5/8 Yellowish Red, Dense, Damp, Non-Plastic, Well Sorted, Mod. Low Permeability	SW SC	14 16 16 17	N/A	HNμ = 0 ppm No Odor
6-8'			No			24"	Well Graded Sand with Trace of Clay, 10 YR 6.5/1 Light Gray, Medium Dense, Trace of Clay, Saturated	SP / SW	13 13 13 14	N/A	HNμ = 0 ppm No Odor
8-10'			No			24"	Poorly Graded Fine Sand with Silt, 2.5 Y 7/2 Light Gray, Medium Dense, Saturated / Well Graded Fine Sand, 10 YR 7/1 Light Gray, Medium Dense, Saturated, Highly Permeable	SP-SW / SW	6 12 14 17	N/A	HNμ = 0 ppm No Odor
10-12'			No			24"	Poorly Graded Fine Sand, 10 YR 7/1 Light Gray, Medium Dense, Saturated, Highly Permeable	SP	8 10 13 14	N/A	HNμ = 0 ppm No Odor
							EOB - 12' bls DTW - 6 'bls				

Depth scale: 2 4 6 8 10 12 14 16

Water Level (at 6)

U = Thin wall tube R = Rock coring
Field G/C (Make/Mod.)

S = Split spoon (tube) O = Other
G/C Oper.:

C = Cuttings Notes:

WELL BORING LOG

Date: 09-5-90

Client/Project: Georgia Air National Guard — BORING/WELL No. 09-WB-05/Background

Installation: Savannah — Site No. 9

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0.02

Logged by: R. Olson — Protection Level: D

Drilling Contractor: E.E.I. — Driller: S. Turner — Drilling Start: 11:40 am — Drilling End: 12:13 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57 — Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 inch.	Water Depth	COMMENTS
0-2'			No			20"	Surface Organics Poorly Graded Fine Sand, 10 YR 2/1 Black, Loose to Medium Dense, Wet, Some Organics, Possibly Fill Material	SP	3 3 7 10	1	HNµ = 0 ppm No Odor
2-4'			No			18"	Sandy Lean Clay, 10 YR 5/2 Grayish Brown, Medium Stiff to Stiff, Wet, No Odor,	CL	5 5 4 4	9	HNµ = 0 ppm No Odor
4-6'			No			24"	Poorly Graded Sand with Clay, 10 YR 5/2 Grayish Brown, Medium Dense, Saturated, Lenses of Sand & Organic Material Well Graded Fine Sand, 10 YR 5/2 Grayish Brown, Medium Dense, Saturated, Highly Permeable	SP-SC SP	9 13 12 15	25	HNµ = 0 ppm Rotting Organic Odor
6-8'			No			24"		SW	5 8 11 11	19	HNµ = 0 ppm No Odor
8-10'			No			24"	Organic Soil, Dark Brown (8-8.5') Well Graded Fine Sand, 10 YR 6/2 Light Brownish Gray, Loose, Saturated	OL SW	3 3 6 10	9	HNµ = 0 ppm Slight Rotting Organic Odor
10-12'			No			24"	Well Graded Sand, 10 YR 5/3 Brown, Medium Dense, Saturated	SW SW	5 15 13 20	28	HNµ = 0 ppm No Odor
12-14'			No			24"	Well Graded Sand with Clay, 7.5 YR 5/8 Strong Brown, Loose to Medium Dense, Saturated, Sulfur Odor	SW-SP	4 4 6 8	10	HNµ = 0 ppm Sulfur Odor
							EOB - 14' bls DTW - 5' bls				

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16

Water Level

U = Thin wall tube — R = Rock coring — Field G/C (Make/Mod.)

(S) = Split spoon (tube) — O = Other — G/C Oper.:

C = Cuttings — Notes:

WELL BORING LOG

Date: 09-10-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 10-WB-01
Installation: Savannah
Site No. 10 - A
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor: E.E.I.
Driller: G. Bray
Drilling Start: 1:45 pm
Drilling End: 2:53 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery ( )	Lithologic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS
0-2'			No			N/A	Asphalt Poorly Graded Fine Sand, 5 Y 4/1 Dark Gray, Fill Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Fill w/ 1" Rocks	SP SP	UK	N/A	HNμ = 10 ppm No Odor
2-4'			No			12"	Poorly Graded Fine Sand, 10 YR 5/4 Yellowish Brown, Dry, Fill Material Poorly Graded Fine Sand, 10 YR 6/2 Light Brownish Gray, Medium Dense, Slightly Damp	SP SP	UK 7 13	N/A	HNμ = 1 ppm No Odor
4-6'			No			18"	Poorly Graded Fine Sand, 10 YR 5/4 Yellowish Brown, Medium Dense, Slightly Damp, No Odor	SP	11 8 7 7	15	HNμ = 2 ppm No Odor
6-8'			No			24"	Poorly Graded Fine Sand, 10 YR 6/3 Pale Brown, Medium Dense, Dry, No Odor Hard Pan Cemented, 5 YR 4/6 Yellowish Red, Very Dense	SP	11 7 23 50/3"	30	HNμ = 4 ppm No Odor HNμ = 1 ppm
8-10'			No			10"	Poorly Graded Fine Sand, 5 YR 4/4 Reddish Brown, Very Dense, Dry, No Odor	SP	33 50/4"	>50	HNμ = 0+ ppm No Odor
10-12'			No			24"	Well Graded Fine Sand, 7.5 YR 4/6 Strong Brown, Very Dense, Saturated below 11', No Odor, HNμ - Slight Response	SW	20 26 30 32	56	HNμ = 0+ ppm No Odor
12-14'			No			24"	Well Graded Fine Sand with Some Gravel, 7.5 YR 4/5 Strong Brown, Medium Dense, Saturated, No Odor	SW	10 11 13 10	24	HNμ = 4 ppm No Odor
14-16'			No			24"	Sandy Silt, 5 Y 6/2 Light Olive Gray, Medium Stiff, Saturated, Non-Plastic, Low Permeability	ML	3 1 4 5	5	HNμ = 0 ppm No Odor
16-18'			No				Poorly Graded Fine Sand, 5 Y 6/1 Light Gray, Loose to Medium Dense, Saturated, No Fines, No Odor	SP	7 6 7 7	13	HNμ = 0 ppm No Odor
							EOB - 18' bls DTW - 11' bls Drummed Cuttings				

2
4
6
8
10
12
14
16
18

Water Level

U = Thin wall tube R = Rock coring Field G/C (Make/Mod.):

S = Split spoon (tube) O = Other G/C Oper.:

C = Cuttings Notes:

WELL BORING LOG

Date: 09-6-90

Client/Project: Georgia Air National Guard
BORING/WELL No 11-WB-01
Installation: Savannah
Site No. 11
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02
Logged by: R. Olson
Protection Level: D
Drilling Contractor E.E.I. Driller: G. Bray
Drilling Start: 11:30 am Drilling End: 12:53 pm
Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'			No			14"	Poorly Graded Fine Sand, 10 YR 6/5 Light Yellowish Brown to Brownish Yellow, Medium Dense, Dry, with Surface Organics	SP	5 6 9 10	15	HNµ = Trace No Odor
2-4'			No			20"	Poorly Graded Fine Sand, 10 YR 6/3 Pale Brown, Medium Dense, Dry Poorly Graded Fine Sand, 7.5 YR 4/2 Dark Brown, Medium Dense, Dry	SP	8 8 6 6	14	HNµ = 1 ppm No Odor
4-6'			No			20"	Poorly Graded Fine Sand, 2.5 YR 2.5/2 Very Dusky Red, Loose, Slightly Damp	SP	2 4 3 3	7	HNµ = 0 ppm No Odor
6-8'			No			12"	Poorly Graded Fine Sand, 2.5 YR 2.5/3 Dark Reddish Brown, Very Dense, Damp, No Odor, Brittle UK - No Recovery	SP UK	25 50/4"	>50	HNµ = 0+ ppm No Odor
8-10'			No			16"	Poorly Graded Fine Sand, 2.5 YR 3/3 Dark Reddish Brown, Very Dense, Damp UK - No Recovery	SP	17 22 50/4"	>50	HNµ = 2 ppm No Odor
10-12'			No			24"	Poorly Graded Fine Sand, 7.5 YR 4/3 Dark Brown, Dense, Saturated, Slight Odor	SP	9 10 21 48	31	HNµ = 2 ppm Fuel Odor
12-14'			No			24"	Poorly Graded Fine Sand, 7.5 YR 4/4 Dark Brown, Very Dense, Saturated, Slight Odor		18 27 42 50/4"	>50	HNµ = 2 ppm Fuel Odor
14-16'			No			24"	Poorly Graded Fine Sand, 10 YR 5/4 Brown, Medium Dense, Saturated, Slight Odor		11 10 16 18	26	HNµ = 5 ppm Slight Odor
							EOB - 16' bls DTW - 8.5' bls Drummed Cuttings				

Depth scale: 2, 4, 6, 8 (Water Level), 10, 12, 14, 16

U = Thin wall tube R = Rock coring ____ Field G/C (Make/Mod.) ____
S = Split spoon (tube) O = Other ____ G/C Oper.: ____
C = Cuttings Notes: ____

WELL BORING LOG

CH2M HILL

Date: 09-6-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 11-WB-02

Installation: Savannah
Site No. 11

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor: E.E.I.   Driller: Turner/Bray
Drilling Start: 4:06 pm   Drilling End: 5:16 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Lithologic Description	USCS	Blows / 6 Inch.	N - Value	COMMENTS
0-2'			No			18"	Poorly Graded Fine Sand with Surface Organics, Grayish Brown, Loose, Dry Poorly Graded Fine Sand, 10 YR 6/5 Brownish Yellow, Medium Dense, Dry, No Odor	SP SP	3 5 9 12	14	HNμ = 0 ppm No Odor
2-4'			No			18"	Poorly Graded Fine Sand, 7.5 YR 6/4 Light Brown, Browner with Depth, Medium Dense, Dry, No Odor	SP	8 8 7 8	15	HNμ = 0 ppm No Odor
4-6'			No			20"	Poorly Graded Fine Sand, 10 YR 3/2 Very Dark Grayish Brown, Loose, Slightly Damp, No Odor	SP	5 4 5 5	9	HNμ = 0 ppm No Odor
6-8'			No			12"	Poorly Graded Fine Sand with Partial Cementation, 2.5 YR 2.5/2 Very Dusky Red, Very Dense, Slightly Damp, Brittle, No Odor	SP	7 50/6"	>50	HNμ = 4 ppm No Odor
8-10'			No			12"	Poorly Graded Fine Sand with Partial Cementation, 2.5 YR 3/4 Dark Reddish Brown, Very Dense, Slightly Moist, Brittle, Some Staining and Odor	SP	19 38 50/2"	>50	HNμ = 20 ppm No Odor
10-12'			No			16"	Poorly Graded Fine Sand with Partial Cementation, 7.5 YR 4/3 Dark Brown, Very Dense, Brittle, Saturated,	SP	12 30 50/5"	>50	HNμ = 1 ppm Fuel Odor
12-14'			No			24"	Poorly Graded Fine Sand, 7.5 YR 4/6 Strong Brown, Very Dense, Saturated, No Odor	SP	18 28 30 31	>58	HNμ = 2 ppm No Odor
14-16'			No			24"	Poorly Graded, Fine Sand, 7.5 YR 4/6 Strong Brown, Medium Dense, Saturated, No Odor Poorly Graded Fine Sand, 10 YR 6/3 Pale Brown, Medium Dense, Saturated, No Odor	SP SP	6 8 10 14	18	HNμ = 1 ppm No Odor
							EOB - 16' bls DTW - 9.5' bls Drummed Cuttings				

2
4
6
8
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14
16

Water Level 8.5' bls

U = Thin wall tube   R = Rock coring   Field G/C (Make/Mod.)

S = Split spoon (tube)   O = Other   G/C Oper.:

C = Cuttings   Notes:

WELL BORING LOG

Date: 09-7-90

Client/Project: Georgia Air National Guard
BORING/WELL No. 11-WB-03

Installation: Savannah
Site No. 11

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0.02

Logged by: R. Olson
Protection Level: D

Drilling Contractor: E.E.I. Driller: G. Bray
Drilling Start: 4:00 pm Drilling End: 4:47 pm

Drilling Method/Rig Type: Continuous SPT / Mobil Drill B-57
Borehole Dia(s): 2"

Depth (ft)	Sample	Sample No.	Lab Anal. (Y/N)	( )	hdsp ( )	Recovery (in)	Litholigic Description	USCS	Blows / 6 inch.	N - Value	COMMENTS	
0-2'			No			16"	Poorly Graded Fine Sand, Surface Organics, Tan Poorly Graded Fine Sand, 7.5 YR 5/6 Strong Brown, Medium Dense, Dry Poorly Graded Fine Sand, 10 YR 6/4 Light Yellowish Brown, Medium Dense, Dry, Possibly Fill Material, No Odor	SP SP SP	5 11 12 12	23	HNμ = 0 ppm No Odor	2
2-4'			No			18"	Poorly Graded Fine Sand, 10 YR 5/2 Grayish Brown, Medium Dense, Dry, Mottled Color, Possibly Fill Material	SP	11 7 7 7	14	HNμ = 0 ppm No Odor	4
4-6'			No			24"	Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Loose, Slightly Damp, No Odor	SP	4 4 3 3	7	HNμ = 0 ppm No Odor	6
6-8'			No			15"	Poorly Graded Fine Sand, 10 YR 3/2 Very Dark Grayish Brown, Loose, Moist, No Odor	SP	4 4 5 3	9	HNμ = 0 ppm No Odor	8
8-10'			No			20"	Poorly Graded Fine Sand with Partial Cementation, 10 YR 2/2 Very Dark Brown, Very Dense, Brittle, Saturated	SP SP	1 2 2 3	4	HNμ = 0 ppm No Odor	Water Level 10
10-12			No			10"	No Recovery	SP	19 50/5"	>50	HNμ = 0 ppm No Odor	12
12-14'			No			24"	Poorly Graded Fine Sand, 10 YR 2/2 Very Dark Brown, Very Dense Poorly Graded Fine Sand, 10 YR 4/4 Very Yellowish Brown, Very Dense, Saturated, No Odor	SP	20 23 45 27	68	HNμ = 0+ ppm Trace No Odor	14
14-16'			No				Well Graded Fine Sand with Lenses of Silty Sand, 2.5 YR 6.5/2 Light Grayish Brown, Medium Dense, Saturated, No Odor	SW	6 11 14 20	25	HNμ = 1 ppm No Odor	16
							EOB - 16' bls DTW - 9' bls					

U = Thin wall tube R = Rock coring ______ Field G/C (Make/Mod.) ______

S = Split spoon (tube) O = Other ______ G/C Oper.: ______

C = Cuttings Notes: ______

TO: Russ Dyer/National Guard Bureau
Del Long/Martin Marietta Energy Systems, Inc.
Dan Oakley/Martin Marietta Energy Systems, Inc.
Jack Elrod/Martin Marietta Energy Systems, Inc.
Tim Cash/Georgia Department of Natural Resources
Greg McIntyre/CH2M HILL/DFB
Ross Sproul/CH2M HILL/GNV
Bob Wright/CH2M HILL/DFB
Nancy Tuor/CH2M HILL/ORO

FROM: Mark Morris/CH2M HILL/DFB
Rick Olson/CH2M HILL/DFB

DATE: October 19, 1990

SUBJECT: Results of groundwater flow investigation and permanent monitor well placement - Georgia Air National Guard Base, Savannah, Georgia

PROJECT: SEF27794.C0

On June 25, 1990, CH2M HILL began field activities to evaluate groundwater flow direction and gradients at nine sites included in the site investigation at the Georgia Air National Guard Base in Savannah, Georgia. The activities included the installation of 15 shallow piezometers, groundwater measurements from the new piezometers and existing monitor wells, and the measurement of surface water elevations from significant canals, ditches, and ponds near each of the sites. Field activities for this phase of the investigation were completed July 14, 1990. In addition to evaluating groundwater flow patterns, field screening was performed using a gas chromatograph at areas of suspected contamination. Results of the screening activities, although not reviewed in this memorandum, are used in conjunction with groundwater flow data to assist in the recommended placement of permanent monitoring wells.

The following technical memorandum describes the activities performed and the results of this investigation. Following the presentation of the data, the placement of permanent monitor wells will be reviewed and revised as necessary.

PIEZOMETER LOCATION SELECTION

Beginning June 30, 1990, 15 piezometers were installed near locations previously agreed upon during preparation of the Site Investigation Sampling and Analysis Plan (SI SAP) by the Guard, HAZWRAP, Georgia Department of Natural Resources, and

CH2M HILL. Piezometer placement (or the need for piezometers) was determined by the following criteria:

- Provide sufficient lateral spacing to reflect site specific conditions (topography, surface water bodies, pavement, etc.).
- Supply necessary potentiometric information at sites with a high potential for groundwater contamination where the groundwater flow direction has not been previously documented.
- Avoid areas of gross contamination (as identified by field screening) and of utility congestion.

Piezometers were placed in locations to supplement data from existing wells and to support data from adjacent sites. In this manner, the fewest total piezometers could be installed while satisfying the data requirements. The following is a review of the needs identified in the SI SAP at each of the 9 sites and the field approach which was agreed upon by reviewers of the plan:

Site No. 1: PERMANENT FIELD TRAINING SITE (PFTS) HANGER/WASHRACK DISCHARGE POINT
No data was available for this site. It was agreed upon by the reviewers of the SI SAP to install three piezometers at the contamination source (washrack) and one piezometer at the point of discharge (drainage ditch). The piezometer at the discharge point was to be used in conjunction with the surface water elevations from the drainage ditch to describe groundwater flow in this area.

Site No. 2: PFTS VEHICLE MAINTENANCE WASHRACK DISCHARGE POINT
No data was available for this site, however, the washrack discharges directly to an oil-water separator then to a drainage ditch. Because the oil-water separator discharges directly into the ditch, a low probability of groundwater contamination exists at this site. Groundwater movement at this site was to be evaluated by monitoring surface water elevations in an adjacent ditch; no piezometers were to be installed at this site.

Site No. 5: 165th TACTICAL AIRLIFT GROUPS (TAG) BULK FUELS STORAGE FACILITY
Two monitor wells exist near an underground storage tank in the southeast quadrant of the facility. Groundwater elevations were to be evaluated by measuring depths to groundwater in the two existing wells and from two new piezometers that were to be installed in locations identified in the SI SAP.

Site No. 6: 165th TAG VEHICLE MAINTENANCE SPILL AREA
No groundwater data was available for this site. To evaluate this site, two piezometers were to be installed on the western site boundary and used in conjunction with one piezometer to be installed at Site No. 7.

Site No. 7: 165th TAG VEHICLE MAINTENANCE WASHRACK
No groundwater data was available for this site. To evaluate this site, one piezometer was to be installed by the eastern site boundary and used with surface water elevations provided by the ditch located adjacent to the site. This data was to be supplemented by measurements obtained from two piezometers located at Site No. 6 and three wells that surround an underground storage tank between Sites Nos. 6 and 7.

Site No. 8: OLD 165th TAG AIRCRAFT WASHRACK
Due to the observation of groundwater flowing into an adjacent drainage ditch, it was assumed that groundwater flows easterly at this site. This observation was further supported by historical data provided in the Preliminary Site Assessment that described groundwater flow as "radially away from the center of the airport property." Based on this observation and assumption, it was decided by the Guard, HAZWRAP, GAEPD, and CH2M HILL that groundwater flow direction could be assumed without verification from piezometers. Should this assumption prove incorrect (by data produced from the future permanent monitor wells) additional wells may be needed to completely describe groundwater quality at this site.

Site 9: 165th TAG CURRENT FIRE TRAINING AREA (FTA)
No groundwater data was available at this site. To evaluate Site No. 9, three piezometers were to be installed around the perimeter of the fire training area in locations previously identified in the SI SAP. The measurements obtained from the piezometers were to be used in addi-

tion to data produced from surface water bodies (a pond located southeast of the FTA and a drainage ditch located northwest of the FTA) to describe groundwater flow at the site.

Site 10: 165th TAG BULK CHEMICAL STORAGE AREA
No groundwater data was available at this site. To evaluate this site three piezometers were to be installed surrounding the bulk chemical storage area at locations previously identified in the SI SAP.

Site 11: 165th TAG OLD BURN AREA
Groundwater flow has been documented at this site during a previous investigation performed by Talbut, Cox, and Associates in 1984. Groundwater flow was assumed to be consistent with past observations as flowing north-northwest. This observation was to be confirmed by taking measurements from wells installed in the previous investigation; if they were still intact.

For additional information about site conditions or piezometer placement, refer to the SI SAP.

PIEZOMETER CONSTRUCTION

Piezometers were constructed from within hollow stem augers as described in the SI SAP. Piezometers were constructed from one-inch diameter threaded PVC casing. The screened section for each well was provided by 5-foot sections of No. 10 factory slot (0.010 inch), PVC screen. A threaded endcap was also installed to prevent sand from entering the piezometer through the end of the casing. Each piezometer was constructed so that a five foot screened interval was completely submerged in groundwater. Total depths of the piezometers ranged from 10.5 to 19 feet below land surface (bls). The borehole surrounding the piezometers was backfilled with 20/40 silica sand and sealed with a two foot bentonite plug. The remaining borehole above the bentonite plug was backfilled with cuttings produced from the piezometer and finished with a flush mounted well box and 3-foot square concrete pad. Prior to backfilling the borehole, the drilling cuttings were screened using an HNu to detect potential contamination. Cuttings from all piezometers were free from volatile organic contamination as indicated by an HNu photo ionization detector.

HORIZONTAL AND VERTICAL SURVEY

A horizontal and vertical survey was performed at each site to establish a reproducible base line (coordinate system), tie the newly installed piezometers to reference points established in the field screening activities, and to measure top-of-casing (TOC) elevations on each of the piezometers and existing wells. The survey was performed by a surveyor licensed in the state of Georgia on July 11 through 14, 1990.

Three bench marks were identified by the Savannah Airport Authority (Engineering Department) near the nine sites. The elevations were transferred from the bench marks to each piezometer and surface water headwall by use of a rod and level. In addition, temporary bench marks were established at each site for future reference. At surface water structures, permanent measuring points were established from which depths to water (and subsequently surface water elevations) could be measured.

The surveyor supplied base line figures identifying existing monitor wells, head walls at surface water structures, reference points from the field screening activities, and the newly installed piezometers. Individual site figures where then overlain onto the base figures to accurately locate piezometer and existing well locations.

Table 1 includes a list of the locations included in the survey. The locations include 15 newly installed piezometers, 8 existing wells, and 6 surface water measuring points. The data points are numbered following a uniform system established in the SI SAP. Each point is identified by the site number, location type (piezometer [PZ], existing well [EW], or surface water body [SW]), and installation order (or a number assigned to an existing well).

Table 1 includes water elevations at each of the data points. Measurements were obtained between 8:30 a.m. and 8:22 p.m. (within a 12-hour period) on July 13, 1990. Piezometer construction details, top-of-casing elevations, and groundwater measurements are also included in Table 1.

GROUNDWATER FLOW DIRECTION

Groundwater flow directions are projected at each of the sites by reviewing surface and groundwater measurements collected on July 13, 1990. At several sites, data has been combined to reinforce or supplement individual site information. Although site figures were not combined for this Technical Memorandum, the base-line figures

TABLE 1
WATER LEVEL DATA
GEORGIA AIR NATIONAL GUARD
SAVANNAH, GEORGIA
JULY 13, 1990

DATA POINT	DESCRIPTION	TOTAL DEPTH MEASURED (Ft BLS)	SCREENED INTERVAL (Ft BLS)	TOC ELEVATION (Ft NGVD)	DEPTH TO WATER (Ft)	GROUNDWATER ELEVATION (Ft NGVD)	TIME
01-PZ-01	SITE 1 - PIEZOMETER 1	11.25	7.5 - 12.5	31.27	4.26	27.01	7:26 P.M.
01-PZ-02	SITE 1 - PIEZOMETER 2	15.90	8.0 - 18.0	41.38	12.08	29.30	7:23 P.M.
01-PZ-03	SITE 1 - PIEZOMETER 3	14.40	10.0 - 15.0	34.39	5.15	29.24	7:16 P.M.
01-PZ-04	SITE 1 - PIEZOMETER 4	12.14	8.0 - 13.0	21.28	3.60	17.68	7:31 P.M.
01-SW-01	SITE 1 - SURFACE WATER 1	N.A.	N.A.	23.56	6.48	17.08	0:45 A.M
02-SW-01	SITE 2 - SURFACE WATER 1	N.A.	N.A.	13.30	3.84	9.46	8:30 A.M.
05-PZ-01	SITE 5 - PIEZOMETER 1	14.84	10.0 - 15.0	12.60	6.32	6.28	8:16 P.M.
05-PZ-02	SITE 5 - PIEZOMETER 2	14.75	10.0 - 15.0	13.97	8.42	5.55	8:22 P.M.
05-EW-01	SITE 5 - EXISTING WELL 1	14.80	U.K.	15.31	8.54	6.77	3:45 P.M.
05-EW-02	SITE 5 - EXISTING WELL 2	14.67	U.K.	15.74	9.25	6.49	3:50 P.M.
06-PZ-01	SITE 6 - PIEZOMETER 1	10.42	5.5 - 10.5	25.18	5.49	19.69	7:37 P.M.
06-PZ-02	SITE 6 - PIEZOMETER 2	13.85	9.5 - 14.5	27.54	3.87	23.67	7:42 P.M.
07-PZ-01	SITE 7 - PIEZOMETER 1	11.12	7.0 - 12.0	23.64	4.34	19.30	7:45 P.M.
07-SW-01	SITE 7 - SURFACE WATER 1	N.A.	N.A.	24.74	4.57	20.17	7:48 P.M.
07-EW-01	SITE 7 - EXISTING WELL 1	11.20	U.K.	27.48	5.90	21.58	2:01 P.M
07-EW-02	SITE 7 - EXISTING WELL 2	11.07	U.K.	27.87	6.58	21.29	2:02 P.M
07-EW-03	SITE 7 - EXISTING WELL 3	10.82	U.K.	28.12	6.91	21.21	2:03 P.M
08-SW-01	SITE 8 - SURFACE WATER 1	N.A.	N.A.	32.44	7.31	25.13	8:10 P.M.
09-PZ-01	SITE 9 - PIEZOMETER 1	12.35	8.5 - 13.5	20.94	4.64	16.30	6:58 P.M.
09-PZ-02	SITE 9 - PIEZOMETER 2	14.75	10.0 - 15.0	21.25	8.01	13.24	7:02 P.M.
09-PZ-03	SITE 9 - PIEZOMETER 3	14.85	10.0 - 15.0	21.18	6.66	14.52	7:06 P.M.
09-SW-01	SITE 9 - SURFACE WATER 1	N.A.	N.A.	20.43	3.95	16.48	6:15 P.M.
09-SW-02	SITE 9 - SURFACE WATER 2	N.A.	N.A.	18.43	6.16	12.27	6:30 P.M.
10-PZ-01	SITE 10 - PIEZOMETER 1	16.70	13.0 - 18.0	44.96	10.56	34.40	7:57 P.M.
10-PZ-02	SITE 10 - PIEZOMETER 2	17.55	13.0 - 18.0	43.69	11.57	32.12	8:06 P.M.
10-PZ-03	SITE 10 - PIEZOMETER 3	18.91	14.0 - 19.0	44.42	8.63	35.79	8:01 P.M.
11-EW-C1	SITE 11 - EXISTING WELL C1	9.50	U.K.	48.03	9.55	38.48	2:30 P.M.
11-EW-C2	SITE 11 - EXISTING WELL C2	U.K.	U.K.	46.12	8.20	37.92	2:15 P.M.
11-EW-D2	SITE 11 - EXISTING WELL D2	U.K.	U.K.	43.45	8.82	34.63	2:48 P.M.

NOTES

U.K. - UNKNOWN
N.A. - NOT APPLICABLE
BLS - BELOW LAND SURFACE
TOC - TOP OF CASING
ALL MEASUREMENTS IN FEET
ELEVATIONS REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD)

prepared by the surveyor (and used for contouring) considered data available from adjacent sites. The following commentary briefly describes groundwater flow patterns observed at each site:

Site No. 1: Groundwater at this site flows southeasterly from the washrack to the drainage ditch. There is a relatively steep (2.2 feet/100 feet) gradient toward the drainage ditch that parallels the topographic gradient. Although the initial projections indicate groundwater flowing into the drainage ditch, it may take several measurements to confirm this observation. These projections were made by reviewing data collected from piezometers, existing wells, and surface water bodies at Sites No. 1, 6, and 7. Figure 1 of Exhibit I reflects groundwater flow direction at Site No. 1.

Site No. 2: No piezometers were installed at Site No. 2; however, when surface water elevations are used with piezometric information supplied from Site No. 5, it appears that groundwater flows generally eastward away from the *drainage ditch*. This flow pattern may vary depending on drainage condition and groundwater levels. This flow pattern will be confirmed during future field measurements. Figure 2 of Exhibit I reflects groundwater flow patterns projected for Site No. 2.

Site No. 5: The potentiometric data produced from Site No. 5 indicates a groundwater mound exists under the Bulk Fuels Facility. This mound is most likely the result of the filled and paved areas and the ditches surrounding the facility. The mound appears to be superimposed upon the regional flow regime. Without the mounding effects, regional groundwater appears to flow east-southeast toward the Pipemaker's Canal. However, in the areas directly adjacent to the Bulk Fuels Facility, it appears that groundwater may flow radially away from the center of the facility.

Site No. 6: Groundwater flow direction at Site No. 6 was projected by interpreting data from Sites No. 1, 6, and 7. From this data, it appears that groundwater flows to the southeast at a moderately steep gradient (2.1 feet/100 feet). This evaluation is consistent with local topography and drainage features. Figure 4 of Exhibit I illustrates groundwater flow direction for Site No. 6.

Site No. 7: Groundwater flow direction at Site No. 7 was projected by evaluating data from Sites No. 1, 6, and 7. From this data, groundwater appears to flow southeasterly across the site. In the vicinity of the drainage ditch, however, groundwater may move into or out of the ditch depending upon recent stormwater runoff. On July 13, 1990, it appears that water from the ditch was recharging groundwater levels. This observation will be confirmed during future field activities. Figure 5 of Exhibit I illustrates groundwater flow direction for Site No. 7.

Site No. 8: No piezometers were installed at Site No. 8, however, by evaluating surface water elevations and potentiometric data from Site No. 10, it appears groundwater flows to the east-southeast. This projection is consistent with the basic assumption that groundwater flows radially away from the center of the airport and with observations of groundwater entering the ditch. Groundwater at this site appears to be captured by the drainage ditch. Figure 6 of Exhibit I illustrates groundwater flow patterns projected for Site No. 8. It should be noted that the groundwater contours prepared for Site No. 8 are only projections using data from a distant site (No. 10) and a surface water body. Actual conditions may vary significantly and will be depicted more precisely when permanent monitor wells are installed.

Site No. 9: Groundwater flow direction at this site was determined from data collected from three piezometers and two surface water bodies. From these measuring points it appears that groundwater flows to the west-southwest. Figure No. 7 of Exhibit I illustrates groundwater flow patterns for Site No. 9.

Site No. 10: Groundwater flow direction at Site No. 10 was evaluated using three piezometers at this site and a surface water elevation from Site No. 8. From this information, it appears that groundwater flows across Site No. 10 to the east-southeast. Figure 8 of Exhibit I illustrates groundwater flow patterns projected for Site No. 10.

Site No. 11: No piezometers were installed at this site, however, three existing monitor wells (C-1, C-2, D-2) were used to provide water level measurements. From this information, it appears that groundwater flows to the north-northwest. This observation is consistent with the anticipated groundwater flow direction for this site and agrees closely with a site

evaluation performed in 1984 by another consultant. Figure 9 of Exhibit I illustrates groundwater flow patterns projected for Site No. 11.

MONITOR WELL PLACEMENT

Based on the results of the field screening and the evaluation of groundwater flow directions, most monitor well locations will remain as originally placed. A summary of the proposed monitor well locations is shown in Exhibit II, and is described as follows:

Site No. 1: Monitor Well 01-MW-01 will remain as originally located in the SI SAP. Well 01-MW-02 will be moved closer to the ditch to observe groundwater quality as influenced by the drainage ditch. The third well at this site will be deleted. The well will be deleted because field screening did not indicate contamination at this site. Additionally, the geology in the area of this proposed well will not yield a sufficient quantity of groundwater to sample.

Site No. 2: No changes; a single well will be installed as originally located in the SI SAP

Site No. 5: Groundwater at this site generally flows radially away from the center of the site. Additionally, contamination was detected during field screening at the northwest corner of the facility and along the ditch north of the facility. Monitor Well 05-MW-01 will be left as originally placed in the SI SAP to observe contamination downgradient of the facility. Monitor Wells 05-MW-02 and 05-MW-03 will be moved downgradient of the observed contamination in the drainage ditch. Because the railroad tracks along the north side of the facility represent the property boundary, wells cannot be installed north of the railroad tracks. Well 05-MW-04 will remain in the same general area; however, it will be moved closer to the facility. Because of the unusual groundwater conditions and the limited data available, a true upgradient well location could not be identified.

Site No. 6: Groundwater at Site No. 6 is projected to flow southeast. The original well placement assumed an easterly groundwater flow. Therefore, the monitor well to be installed at this site will be moved south and west of the original location to account for the observed groundwater flow

direction. This well will now be installed in a wooded area and may require additional effort to clear access for a drill rig. Because this well is now to be installed in a low-lying and wooded area, it is requested that this well be constructed with an aboveground locking cap rather than a flush-mount well box.

Site No. 7: The monitor well to be installed at this site will be moved further west and south, away from the influence of the ditch. This placement will be performed to reduce the effects of water leaching from the drainage ditch and to move the well closer to an area downgradient of contamination detected during the field screening.

Site No. 8: At Site No. 8, it was originally assumed that groundwater flowed east-northeast. Based on the projections of flow using the piezometers at Site No. 10 and the surface water at Site No. 8, it appears that groundwater actually flows to the east. To reflect this new direction, 08-MW-01 and 08-MW-03 will be moved to the northwest to more accurately describe water quality downgradient of contamination (as detected during field screening) locations. Well 08-MW-02 will be moved northwest onto the pavement to reflect upgradient water quality. Well 08-MW-04 will be moved northwest of the original location to serve as a distant downgradient well and will be used to assess water quality exiting the site.

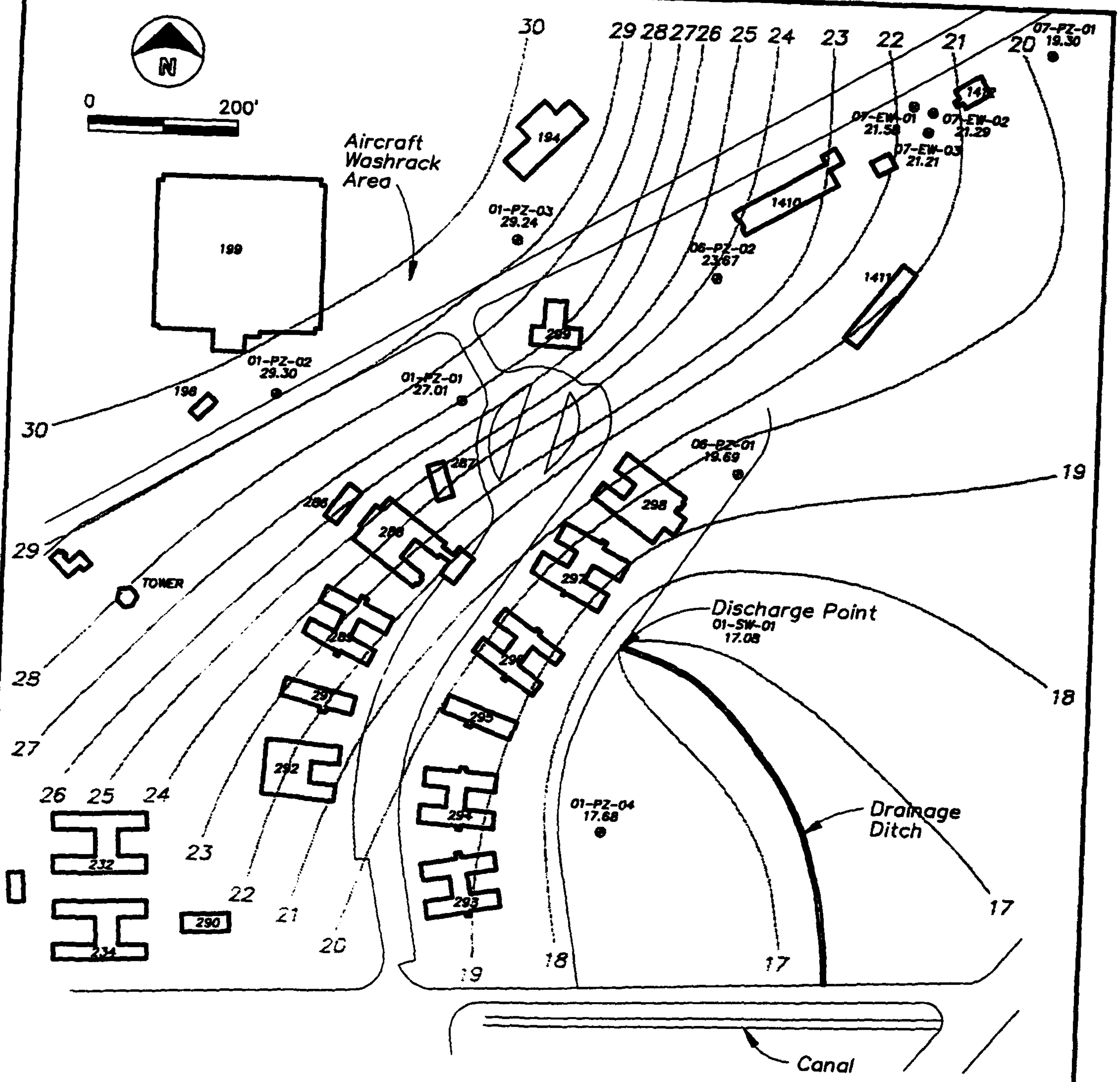
Site No. 9: Groundwater flow at Site No. 9 has been identified to the west-southwest. From the groundwater flow direction and the points of apparent contamination, three of the monitor wells should be moved. Well 09-MW-04 should be moved to the southwest side of the FTA. No contamination was detected near its original location. The new location of this well will reflect groundwater quality downgradient of the FTA. Well 09-MW-03 should be moved to the north to reflect groundwater flow direction. In this location, well 09-MW-03 will observe groundwater downgradient of the oil-water-separator and define the extent of contamination. Monitor Well 09-MW-01 should be moved west, closer to the swale/point of discharge. In this location, the well may define the extent of contaminant migration north of the discharge point. Well 09-MW-02 should be left as originally located in the SI SAP.

Site No. 10: The location of the monitor well at Site No. 10 will be repositioned to the north to more accurately reflect the groundwater flow direction. This well will be installed downgradient of the bulk chemical storage area (an area identified as a contamination source during the field screening).

Site No. 11: The monitor wells at Site No. 11 must be repositioned to replace wells which no longer exist. Of the wells originally installed (during a previous investigation performed by Talbut, Cox, and Associates) only wells B3, C1, C2, C3X and D2 still exist and are in locations which will be useful. Well B3 will now serve as an upgradient (background) well, while Well C3X will serve as a well within of the source. Should Well C3X not be suitable for sampling, the well deleted from Site No. 1 (01-MW-01) will be installed near this location. Additionally, the burn area represents a smaller area than originally depicted. To accurately reflect the smaller area and to compensate for the missing wells, the two new wells will now be installed downgradient of the burn area to the north and west.

Exhibit I
GROUND WATER CONTOURS

08-15-90



LEGEND

- PIEZOMETER
- EXISTING MONITOR WELL
- —23— CONTOUR INTERVAL (FEET NGVD)

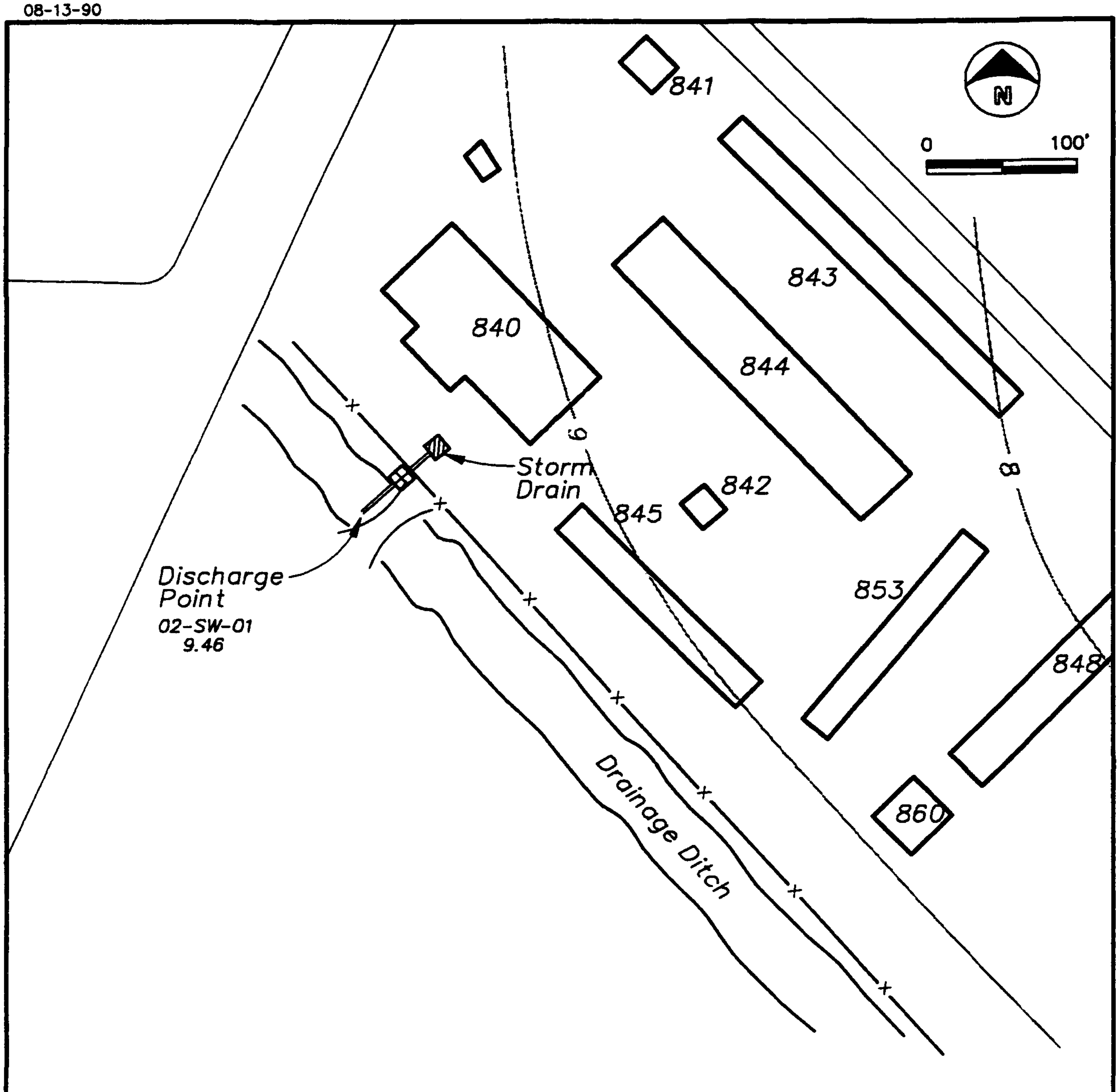
FIGURE 1

SITE NO.1
PFTS HANGAR/WASHRACK DISCHARGE POINT
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

F:\P_SMITH\02SITE1.DWG

08-13-90



LEGEND

⊞ OIL/WATER SEPARATOR
—x— FENCE LINE
—9— CONTOUR INTERVAL (FEET NGVD)

FIGURE 2

SITE NO.2
PFTS VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

F:\P_SMITH\02SITE2.DWG

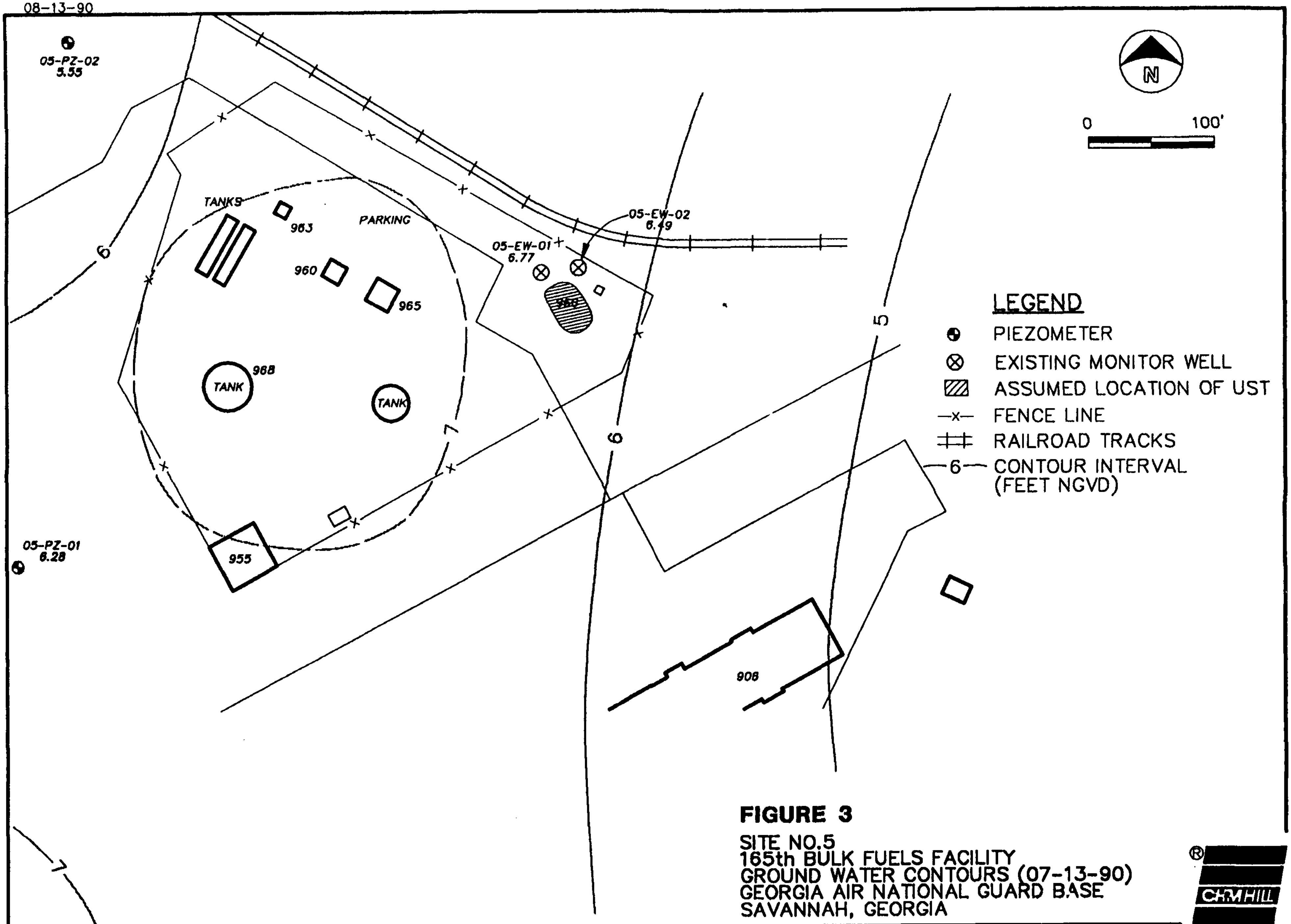


FIGURE 3

SITE NO.5
165th BULK FUELS FACILITY
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

F:\P_SMITH\02SITE5.DWG

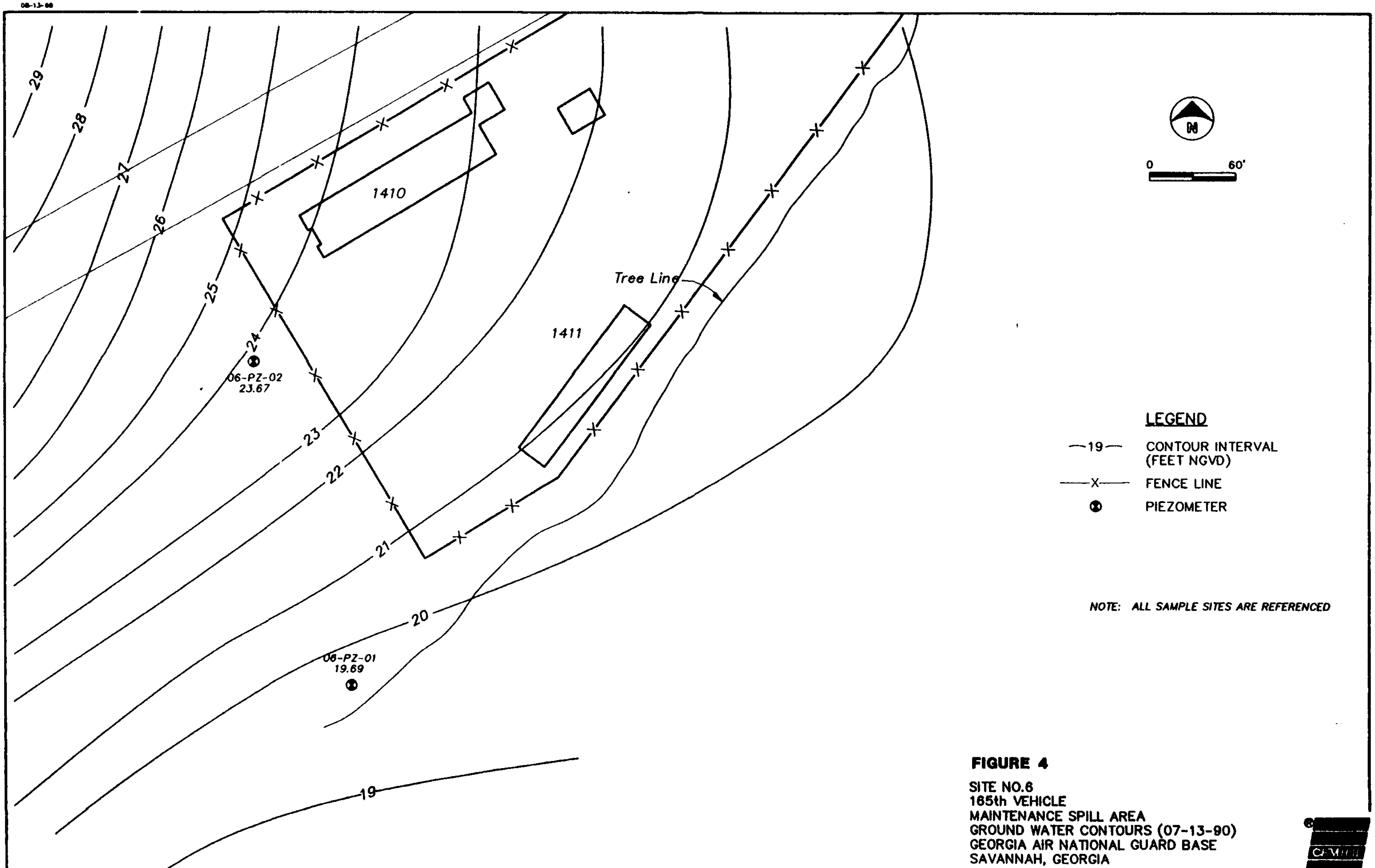


FIGURE 4

SITE NO.6
165th VEHICLE
MAINTENANCE SPILL AREA
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

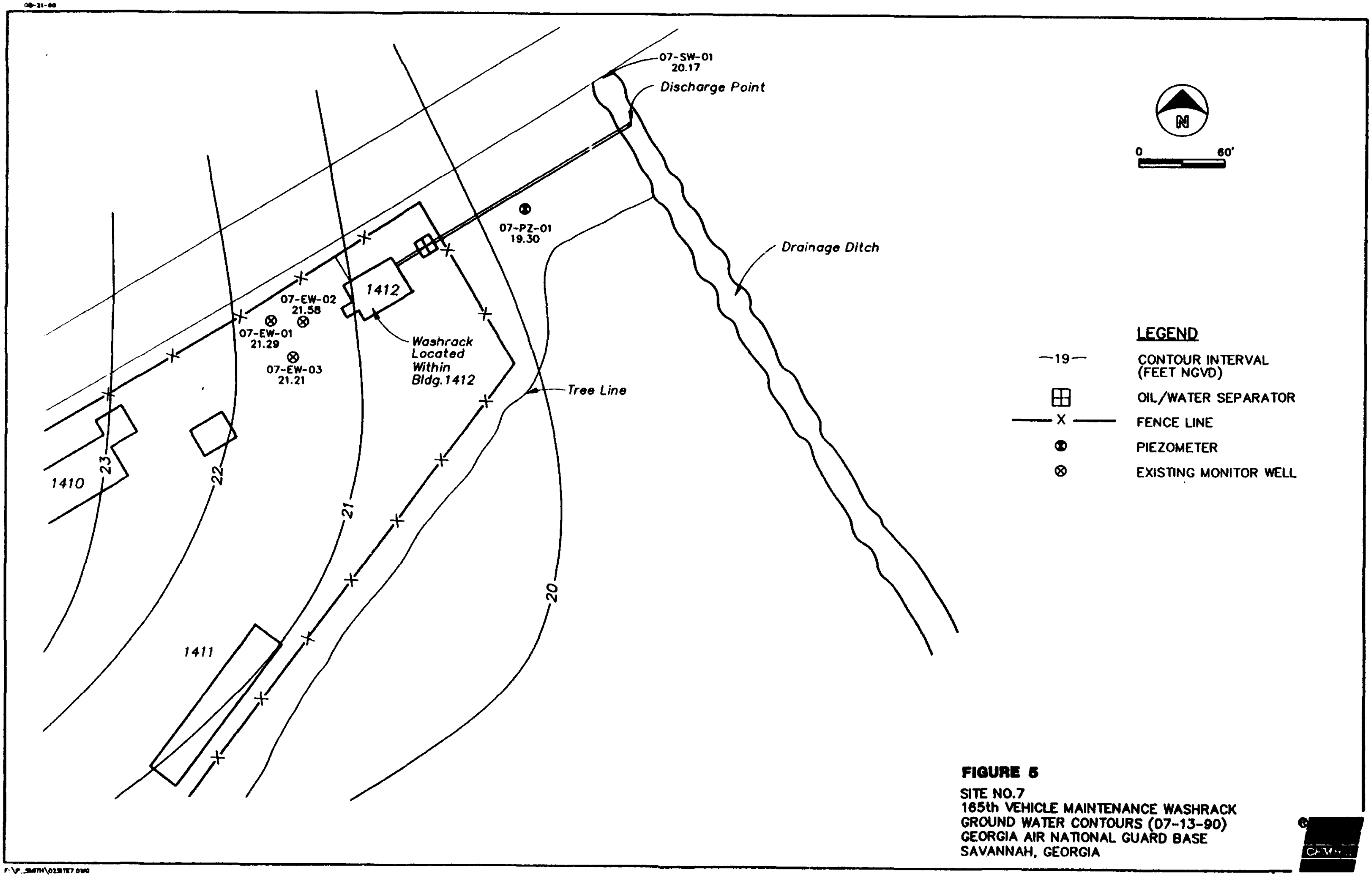


FIGURE 5

SITE NO.7
165th VEHICLE MAINTENANCE WASHRACK
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

08-13-90

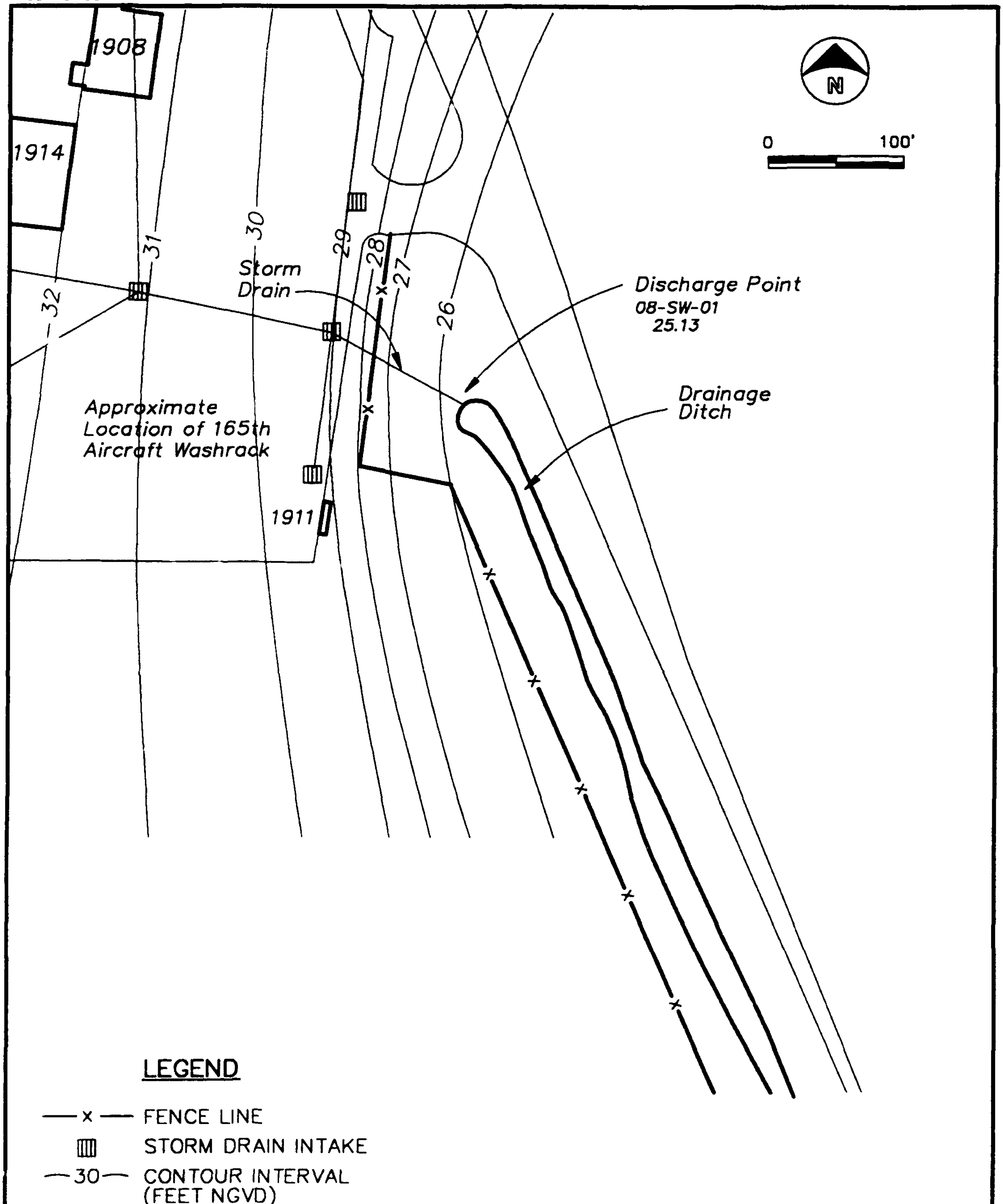


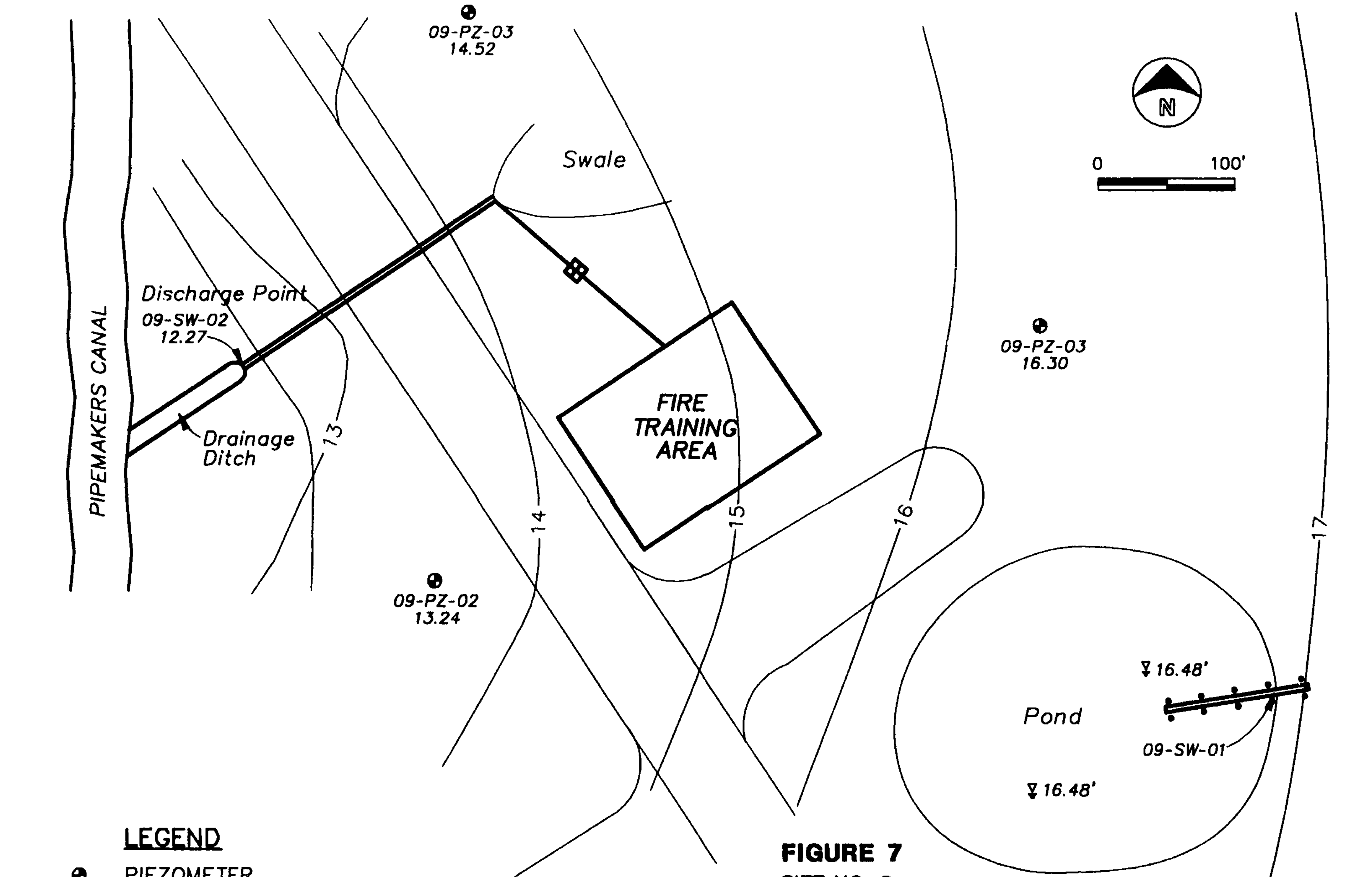
FIGURE 6

SITE NO.8
OLD 165th AIRCRAFT WASHRACK
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

F:\P_SMITH\02SITE8.DWG

08-13-90



LEGEND

- ● PIEZOMETER
- ⊞ OIL WATER SEPARATOR
- —13— CONTOUR INTERVAL (FEET NGVD)

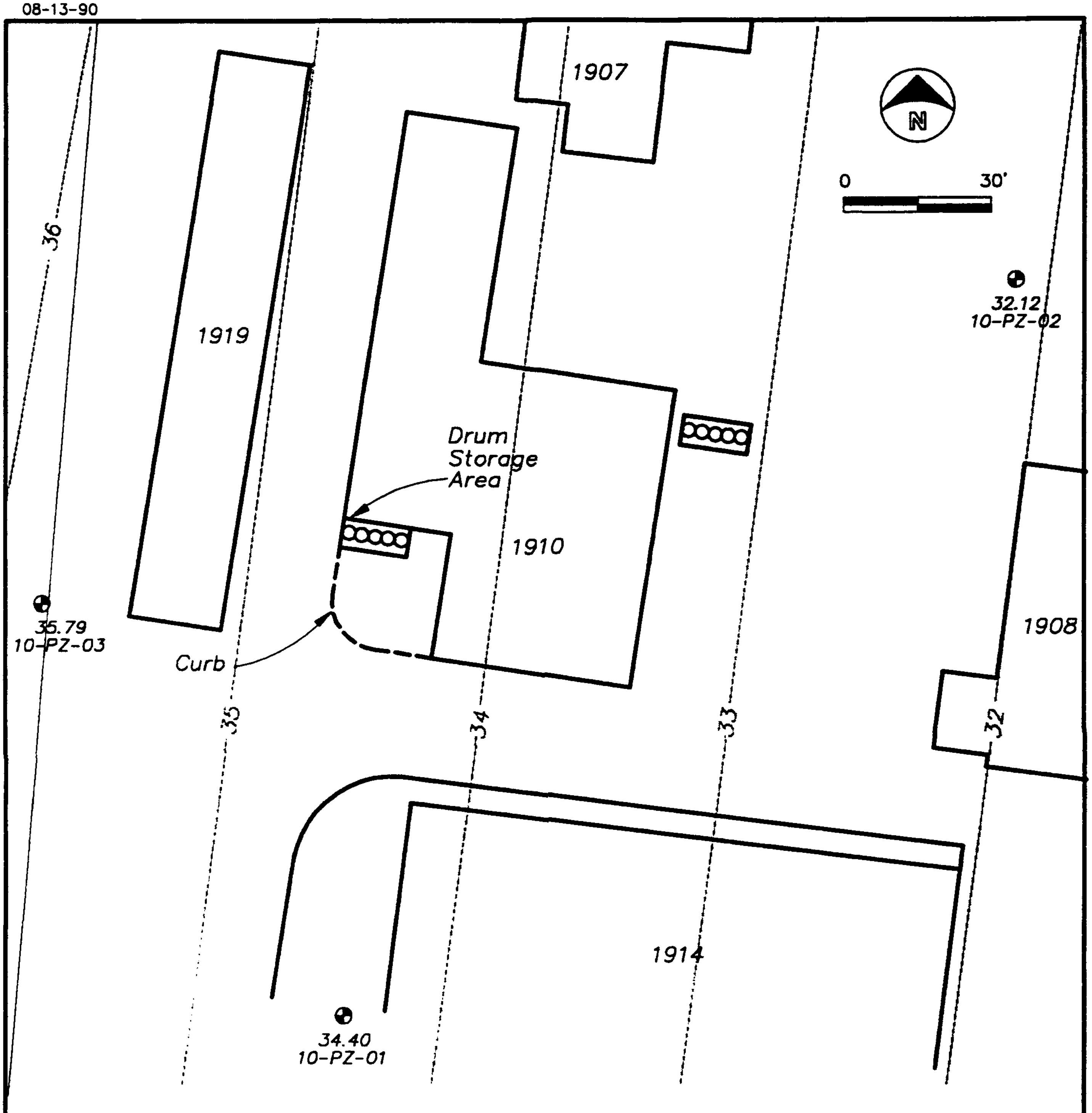
FIGURE 7

SITE NO. 9
165th CURRENT FIRE TRAINING AREA
GROUND WATER CONTUORS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

F:\P_SMITH\02SITE9.DWG

08-13-90



LEGEND

PIEZOMETER

—36— CONTOUR INTERVAL (FEET NGVD)

FIGURE 8

SITE NO.10
165th BULK CHEMICAL STORAGE AREA
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

F:\P_SMITH\02SITE10.DWG

08-13-90

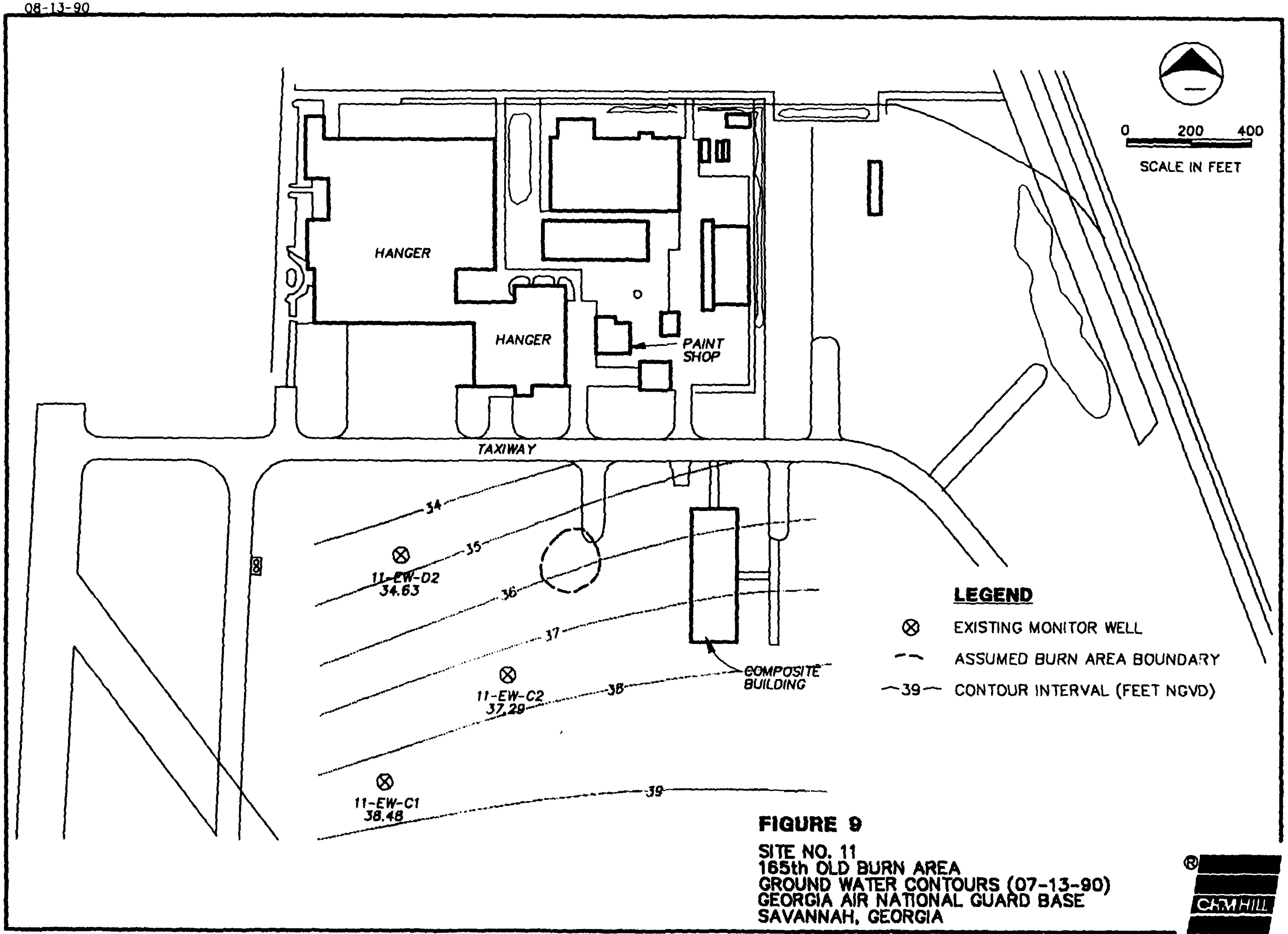


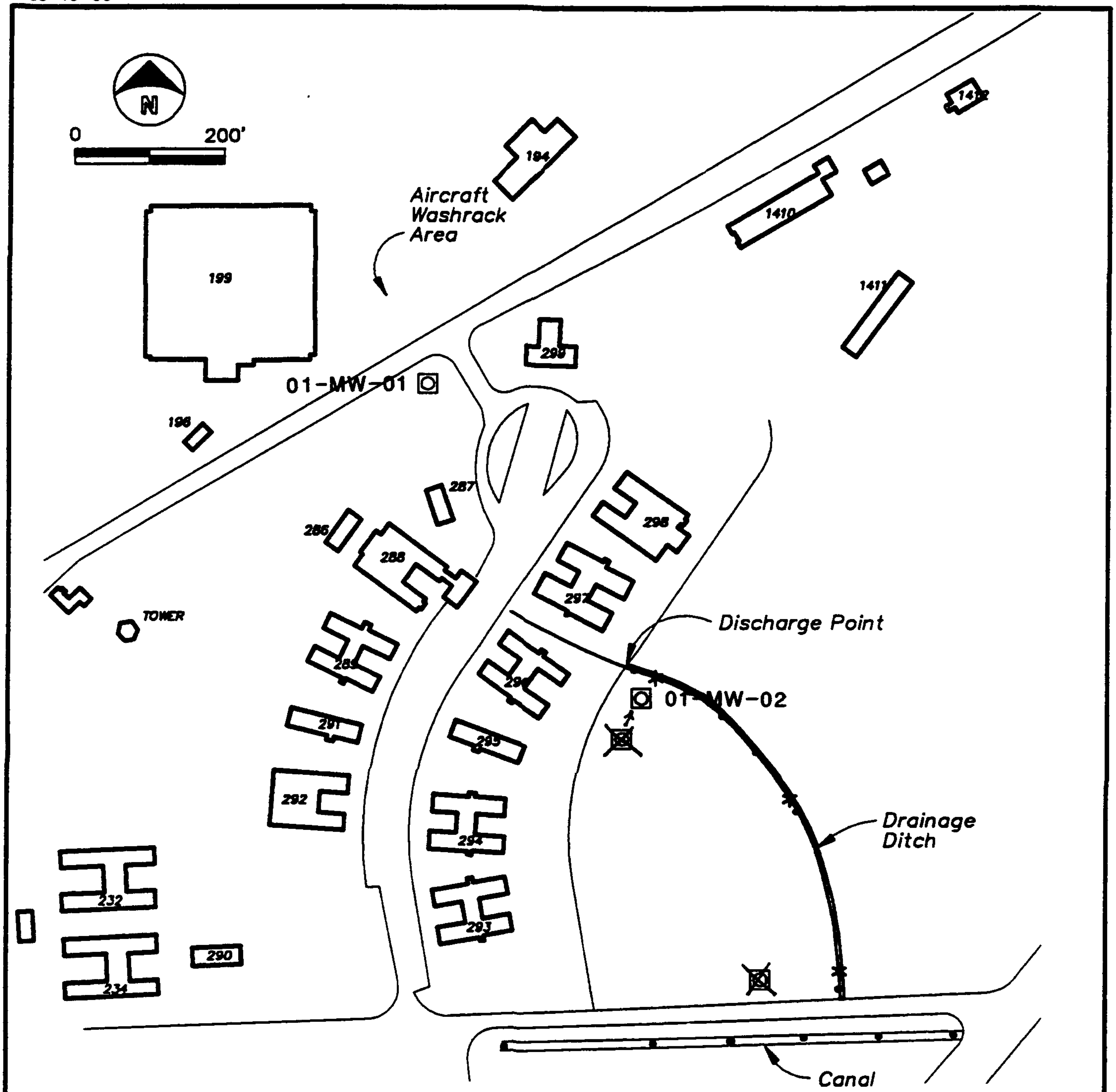
FIGURE 9

SITE NO. 11
165th OLD BURN AREA
GROUND WATER CONTOURS (07-13-90)
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

F:\P_SMITH\02SITE11.DWG

Exhibit II
REVISED MONITOR WELL PLACEMENT

03-16-90



LEGEND

- MONITOR WELL
- • SEDIMENT SAMPLE
- * SURFACE WATER SAMPLE

NOTE: ONE SURFACE WATER SAMPLE WILL BE COLLECTED UPSTREAM OF WASHRACK AREA IF POSSIBLE

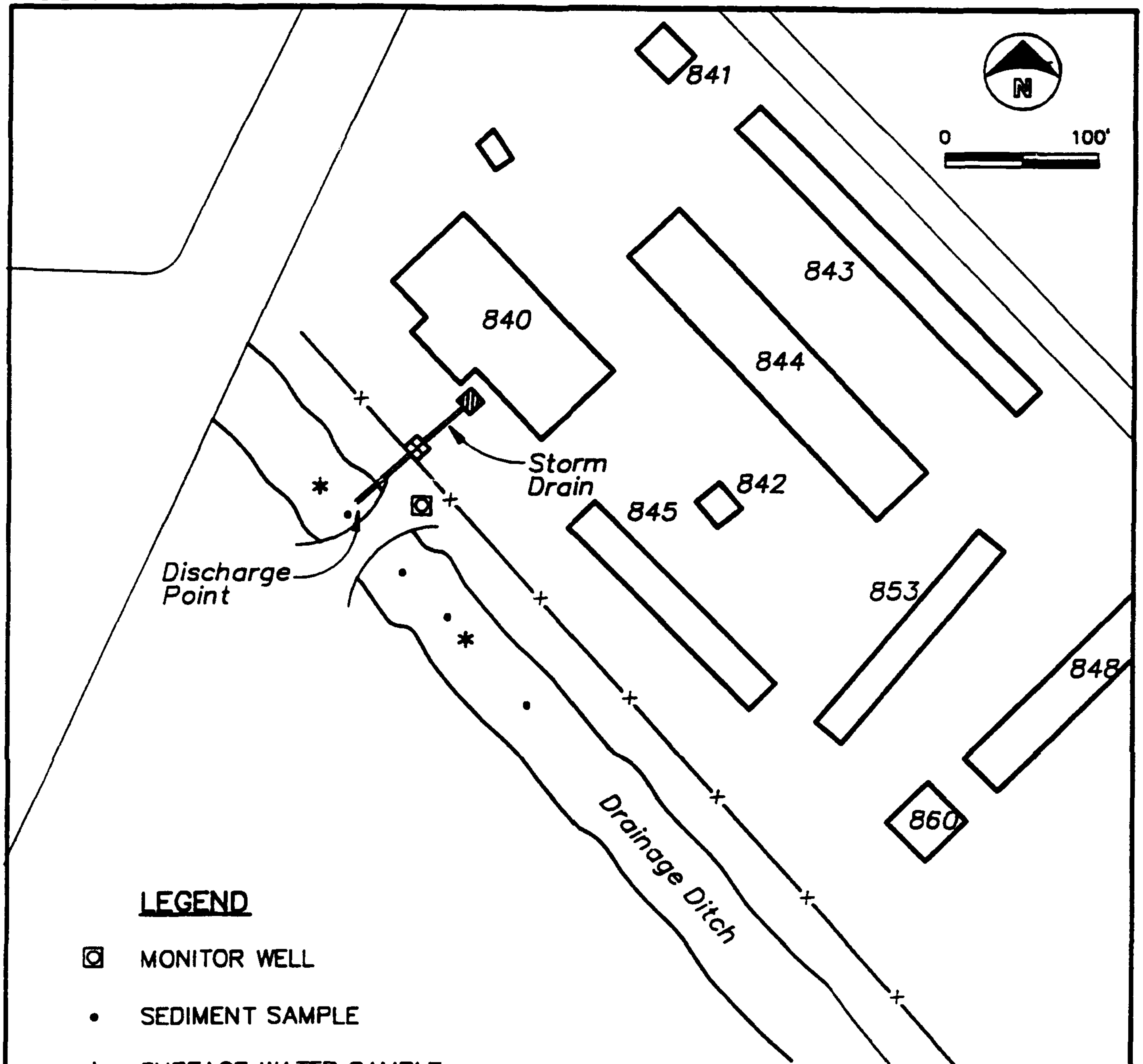
FIGURE A-3

SITE NO.1
PFTS HANGAR/WASHRACK DISCHARGE POINT
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D: \PDS\SEF27794.CO\SITE1B.DWG

02-27-90



LEGEND

- MONITOR WELL
- • SEDIMENT SAMPLE
- * SURFACE WATER SAMPLE
- —x— FENCE LINE
- OIL/WATER SEPARATOR

FIGURE A-5

SITE NO.2
PFTS VEHICLE MAINTENANCE
WASHRACK DISCHARGE POINT
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

D:\PDS\SEF27794.CO\SITE2B.DWG

02-27-90

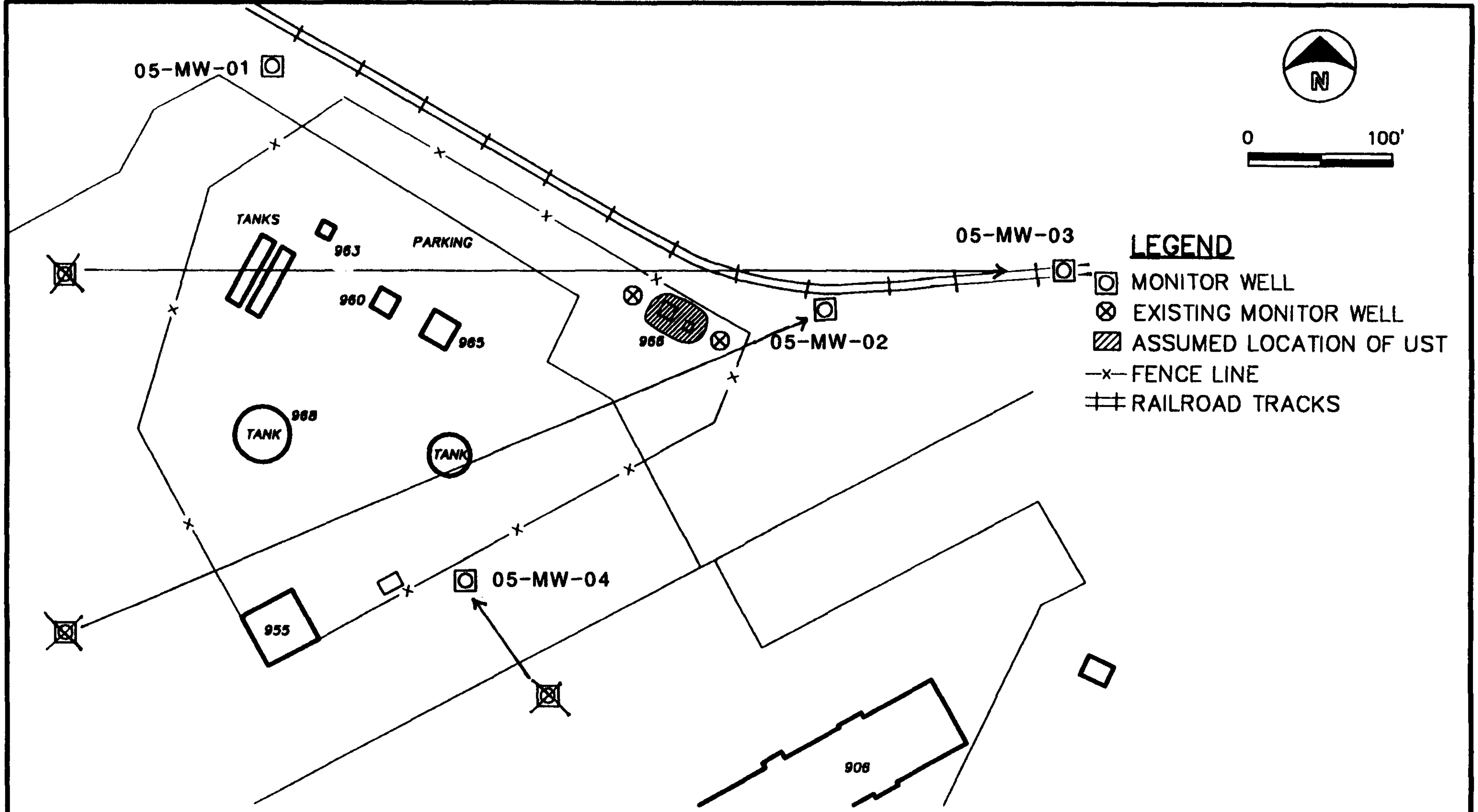


FIGURE A-7

SITE NO.5
165th BULK FUELS FACILITY
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D:\PDS\SEF27794.CO\SITE5B.DWG

03-16-90

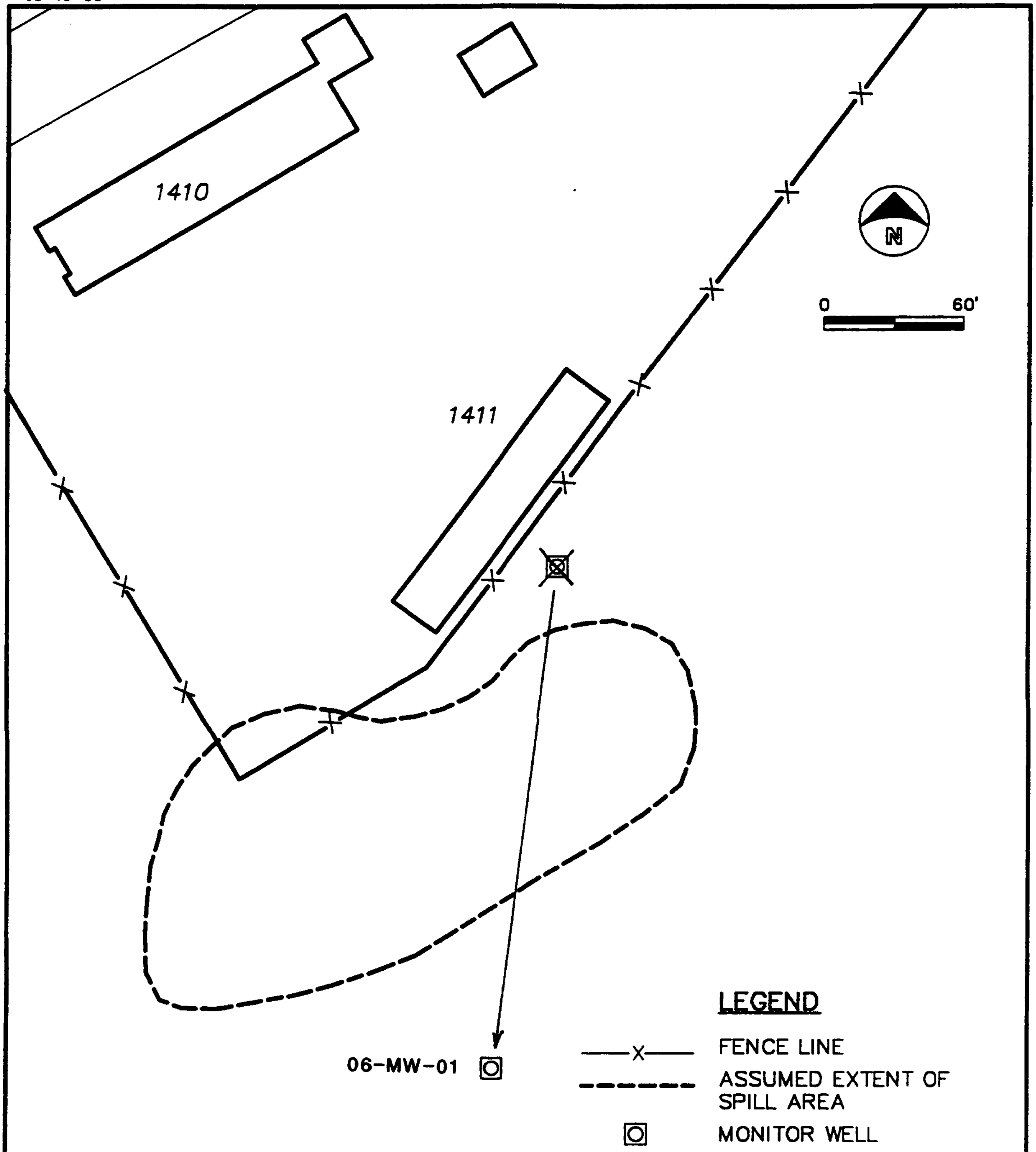


FIGURE A-9

SITE NO.6
165th VEHICLE
MAINTENANCE SPILL AREA
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D: \PDS\SEF27794.CO\SITE6A.DWG

03-16-90

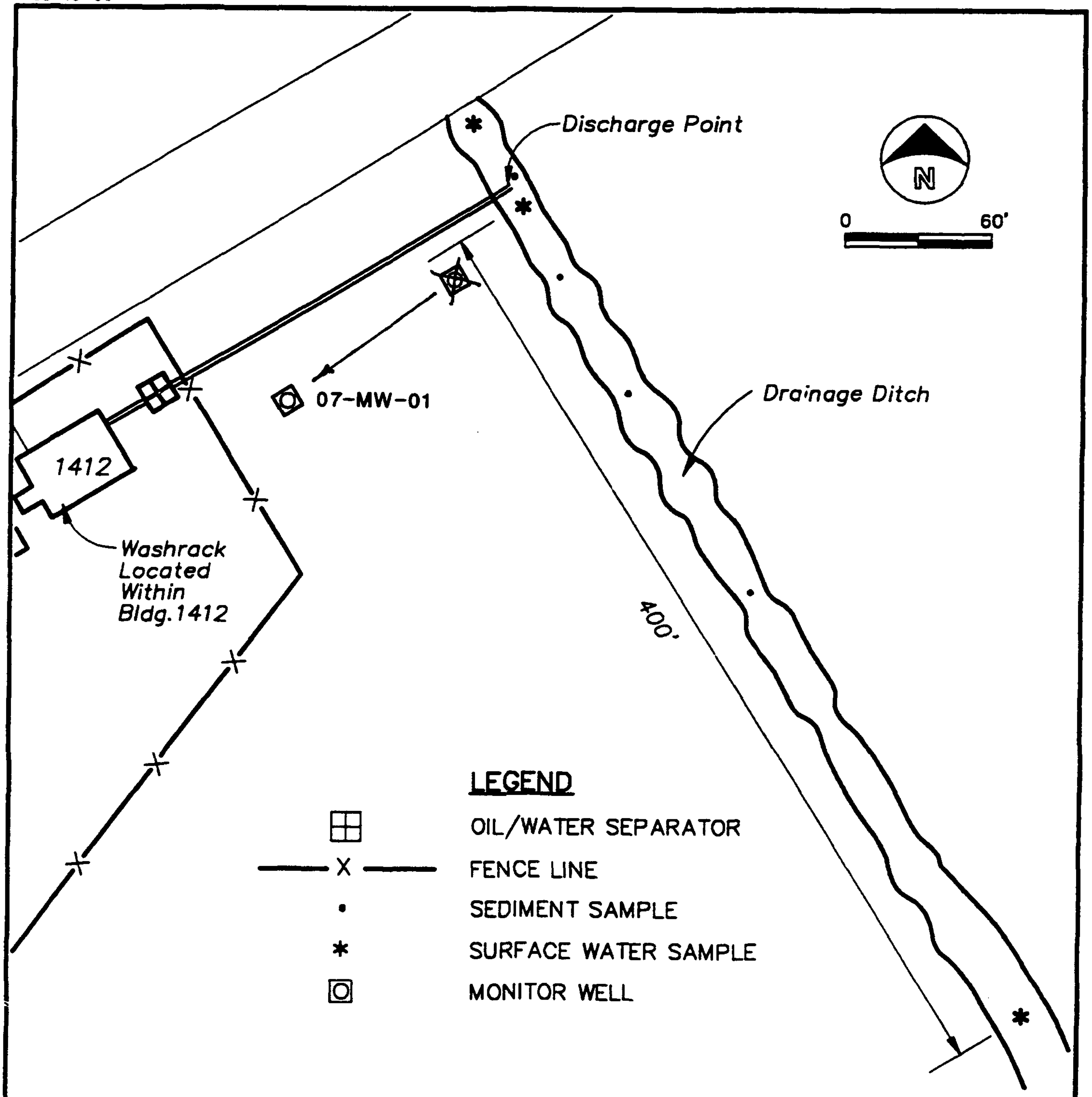


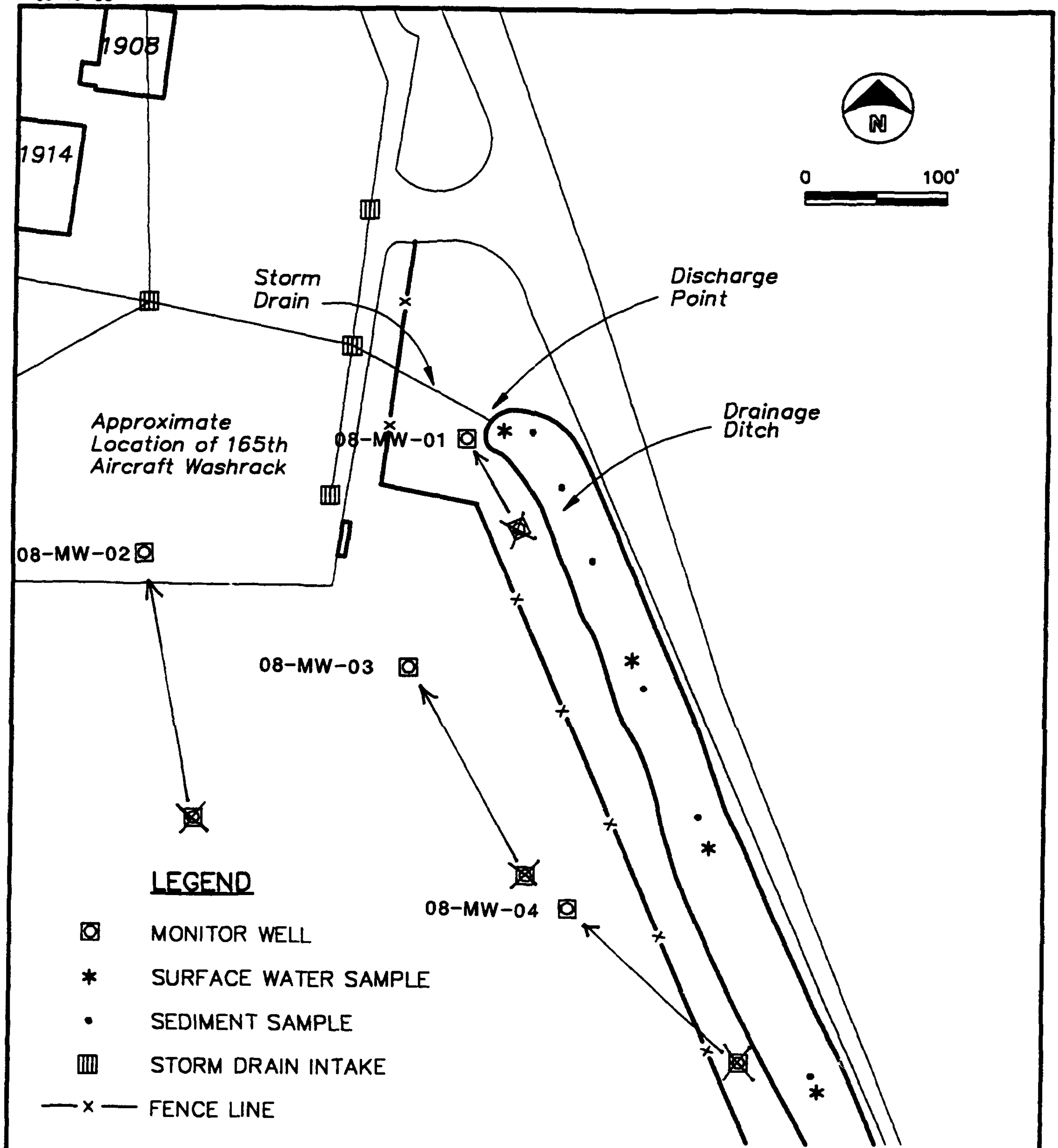
FIGURE A-11

SITE NO.7
165th VEHICLE MAINTENANCE WASHRACK
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D: \PDS\SEF27794.CO\SITE7B.DWG

03-16-90



NOTE: SURFACE WATER SAMPLES WILL BE OBTAINED AT UP TO TWO LOCATIONS OF GROUND WATER SEEPAGE INTO THE DRAINAGE DITCH.

FIGURE A-13

SITE NO.8
OLD 165th AIRCRAFT WASHRACK
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D:\PDS\SEF27794.CO\SITE8A.DWG

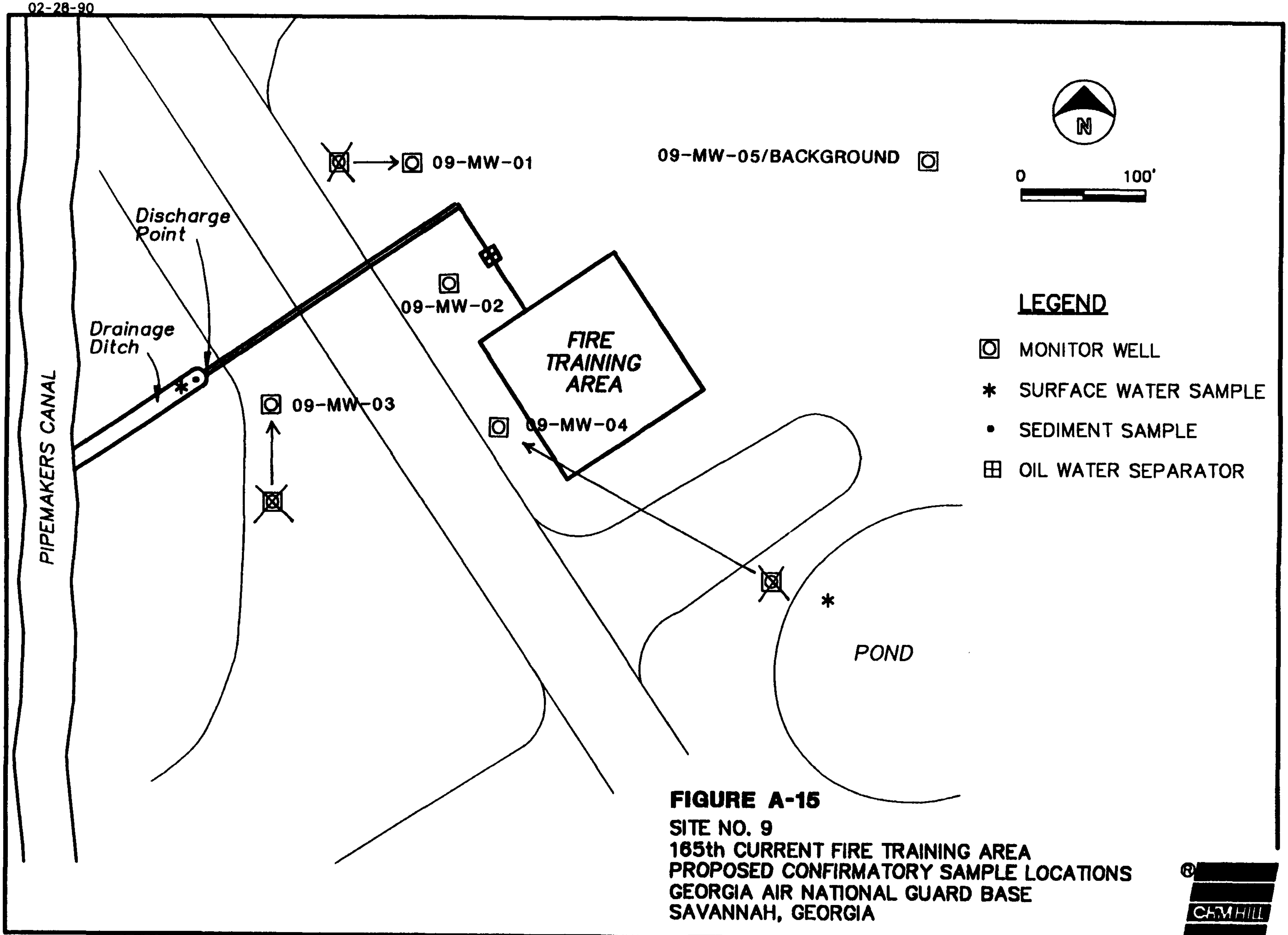


FIGURE A-15
SITE NO. 9
165th CURRENT FIRE TRAINING AREA
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D: \PDS\SEF27794.CO\SITE9A.DWG

02-28-90

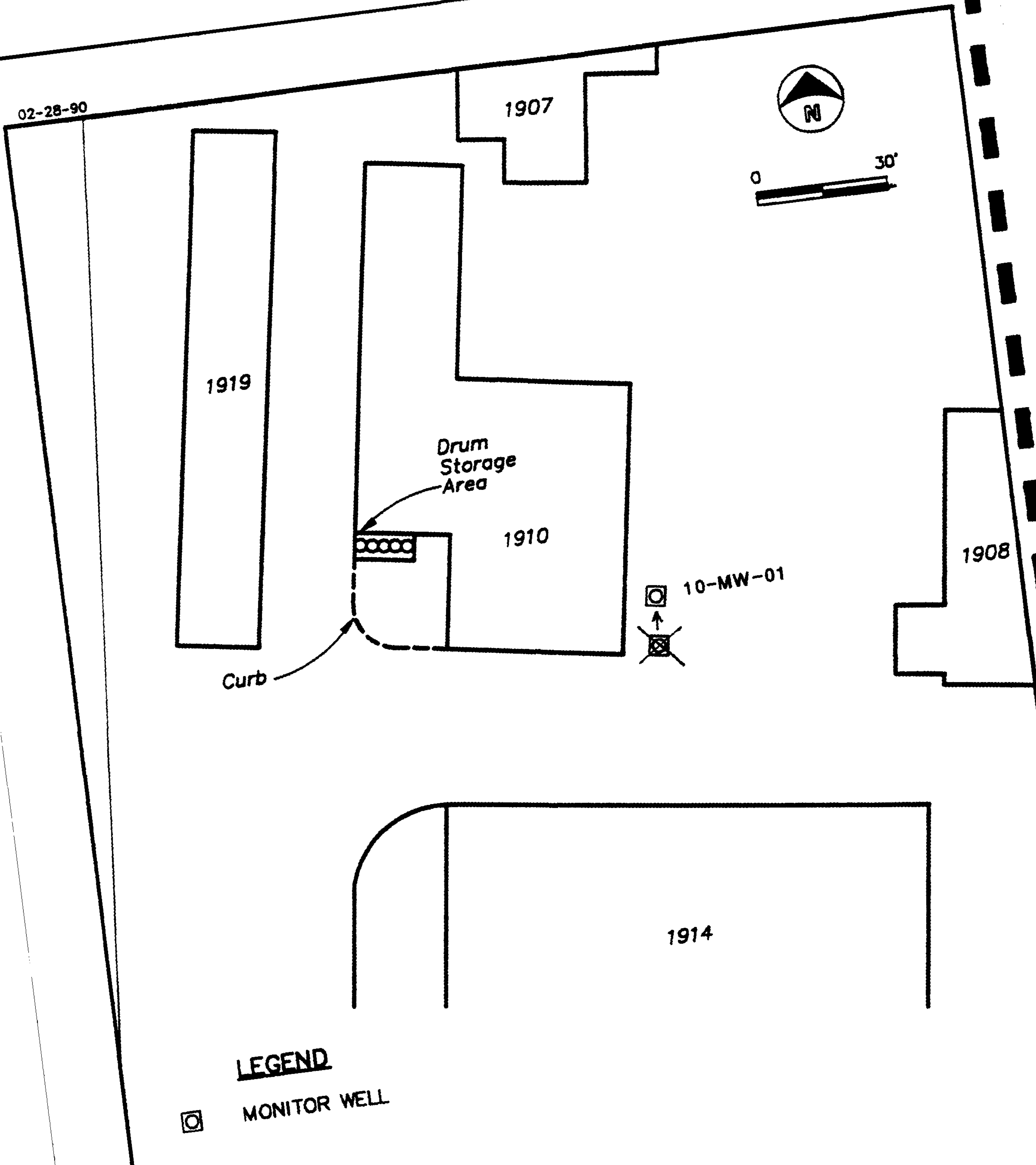


FIGURE A-17
SITE NO.10
165th BULK CHEMICAL STORAGE AREA
PROPOSED CONFIRMATORY SAMPLE LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

D:\PDS\SFF27794.CO\SITE10A.DWG

02-28-90

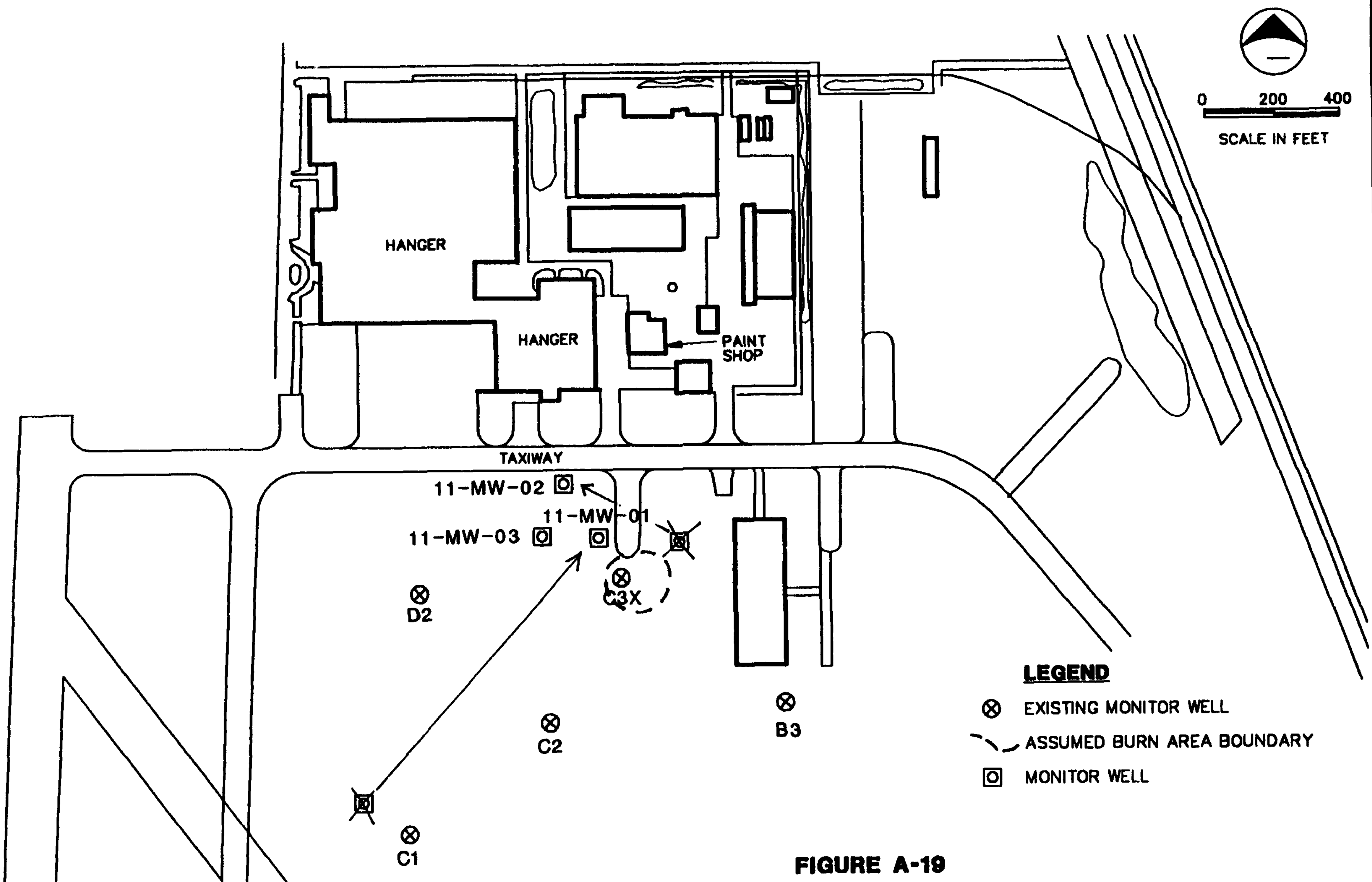


FIGURE A-19

SITE NO. 11
165th OLD BURN AREA
PROPOSED CONFIRMATORY SAMPLING LOCATIONS
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

CH2M HILL

D:\SEF27794.B0\S11.DWG

Piezometer Construction Details

PIEZOMETER CONSTRUCTION DETAIL

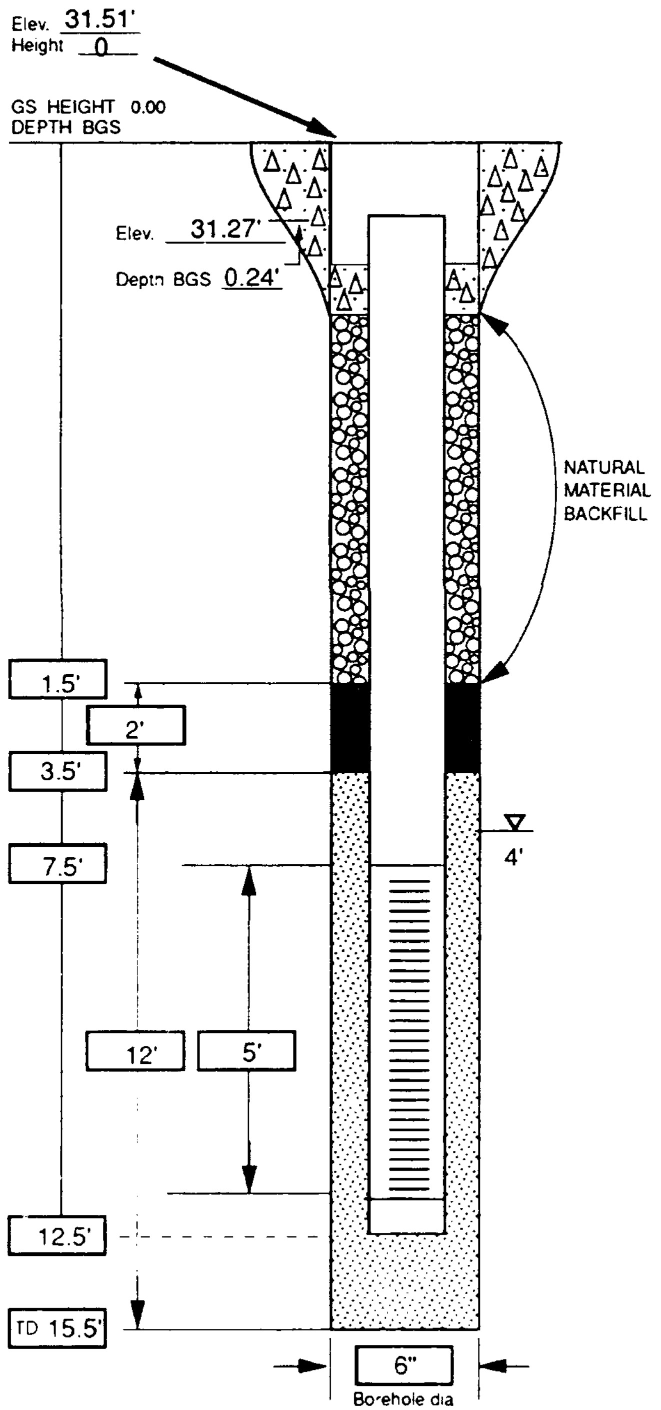
Client/Project: Georgia Air National Guard | Date 7/3/90

Installation: Savannah | Site No. 1

HAZWRAP Contractor: CH2M HILL | Piezometer No. 01-PZ-01

Built by: R. Olson | Project No. SEF27794.C0

Drilling Contractor E.E.I. | Comp Start: 7:45 am Comp. End: 9:00 am



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 10:55 am)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 0 - 7.5'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services - Hole Plug

Setup / Hydration time 45 min Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 200 lbs

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 7.5' - 12.5' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

Client/Project: Georgia Air National Guard

Date 7/2/90

Installation: Savannah

Site No. 1

HAZWRAP Contractor: CH2M HILL

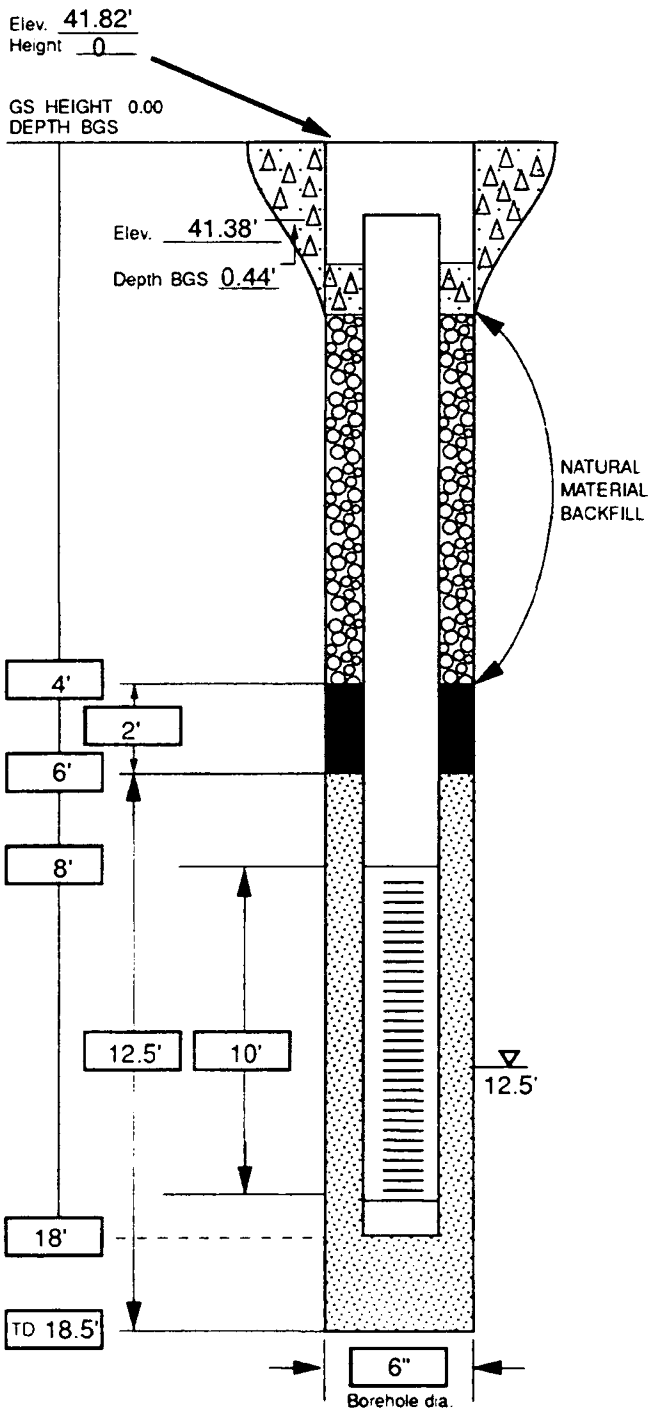
Piezometer No. 01-PZ-02

Built by: R. Olson

Project No. SEF27794.C0

Drilling Contractor E.E.I.

Comp Start: 8:37 am Comp. End: 10:05 am



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (Completed 7/4 5:00pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 0 - 8'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N)

Interval Above 2' BGS

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services - Hole Plug

Setup / Hydration time 15 min Vol. Fluid Added 2 gal.

Tremied (Y/N)

FILTER PACK

Type Silica Sand

Amt Used 250 lbs

Tremied (Y/N)

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 8 - 18' BGS

SUMP (Y/N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Threaded

BACKFILL PLUG (Y/N)

Material N/A

Setup / Hydration time N/A

Tremied (Y/N)

PIEZOMETER CONSTRUCTION DETAIL

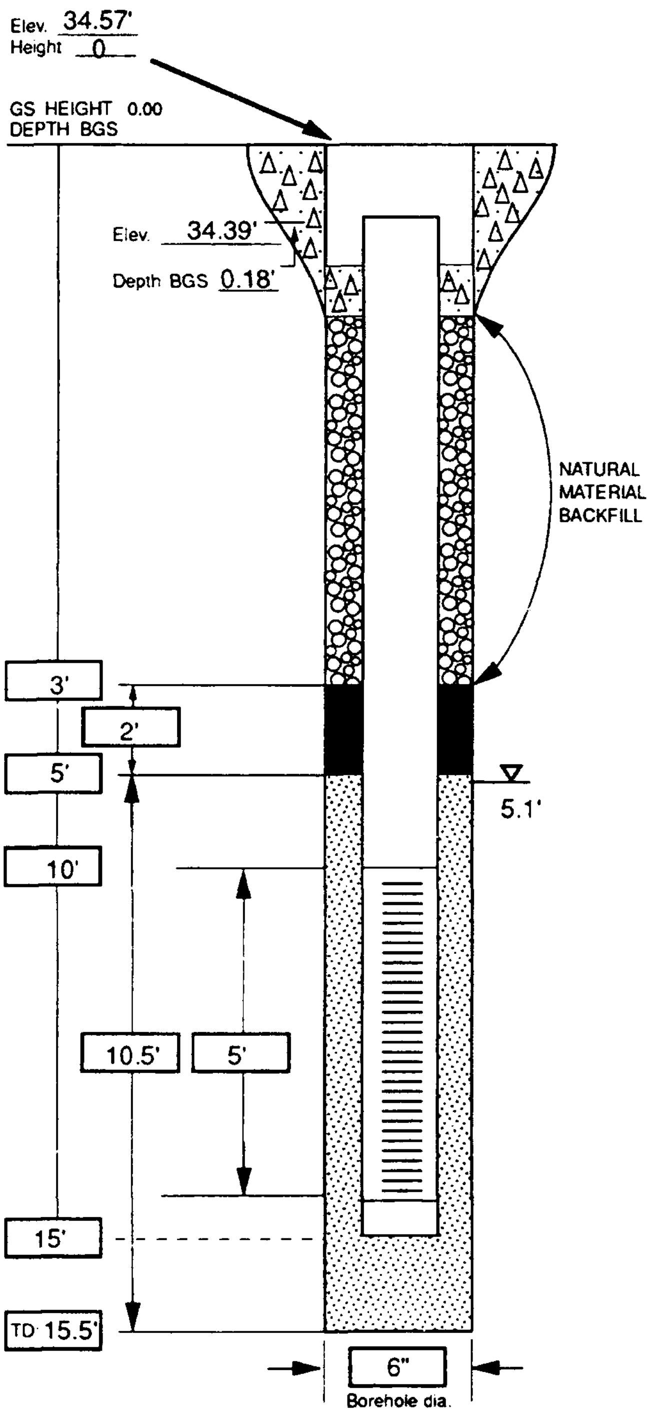
Client/Project: Georgia Air National Guard
Date 7/3/90

Installation: Savannah
Site No. 1

HAZWRAP Contractor: CH2M HILL
Piezometer No. 01-PZ-03

Built by: R. Olson
Project No. SEF27794.C0

Drilling Contractor E.E.I.
Comp Start: 10:40 am Comp. End: 11:20 am



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 9:15)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 0 - 10'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services - Hole Plug

Setup / Hydration time 16 min. Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 140 lbs

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 10 - 15' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

CH2M HILL

Client/Project: Georgia Air National Guard

Date 7/2/90

Installation: Savannah

Site No. 1

HAZWRAP Contractor: CH2M HILL

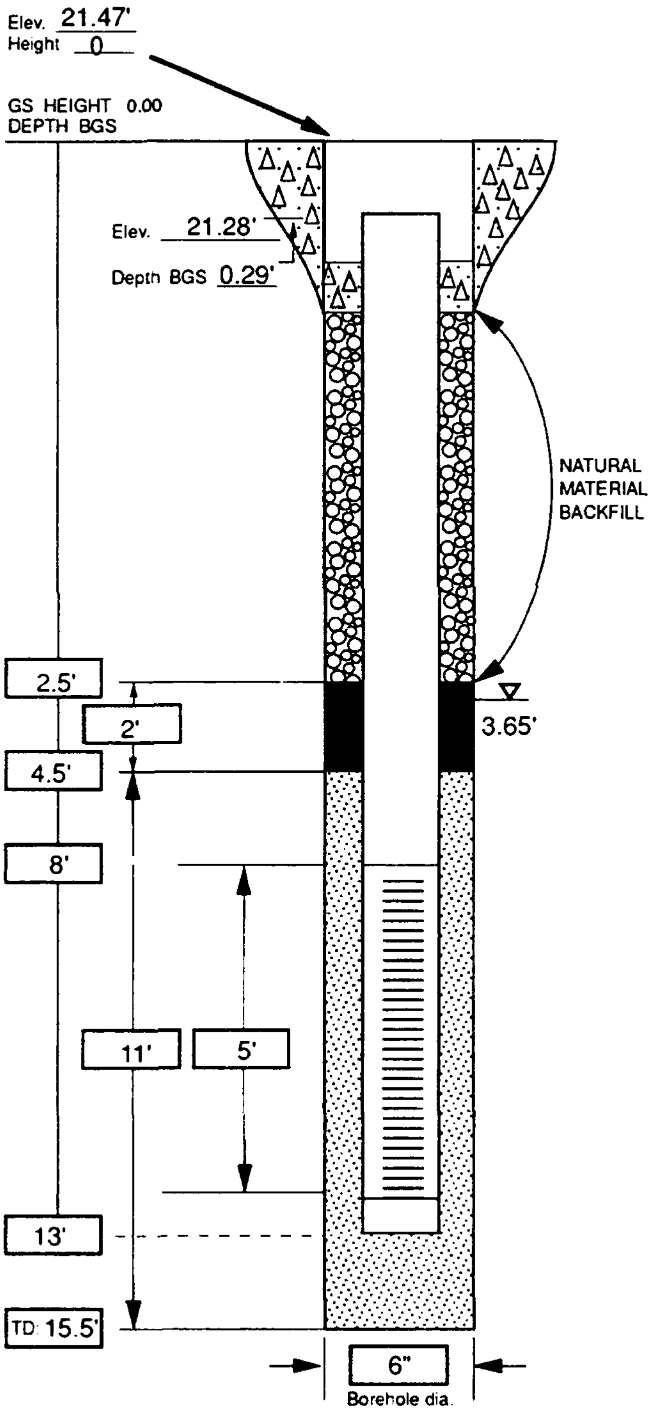
Piezometer No. 01-PZ-04

Built by: R. Olson

Project No. SEF27794.C0

Drilling Contractor E.E.I.

Comp Start: 3:10 pm Comp. End: 4:30 pm



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 12:20 pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 8'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Pelletized Bentonite - 25 pounds

Source Polymer Drilling Services - Pel. Plug

Setup / Hydration time 40 min Vol. Fluid Added none

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 1.5 bags 100 lbs

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 8 - 13' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

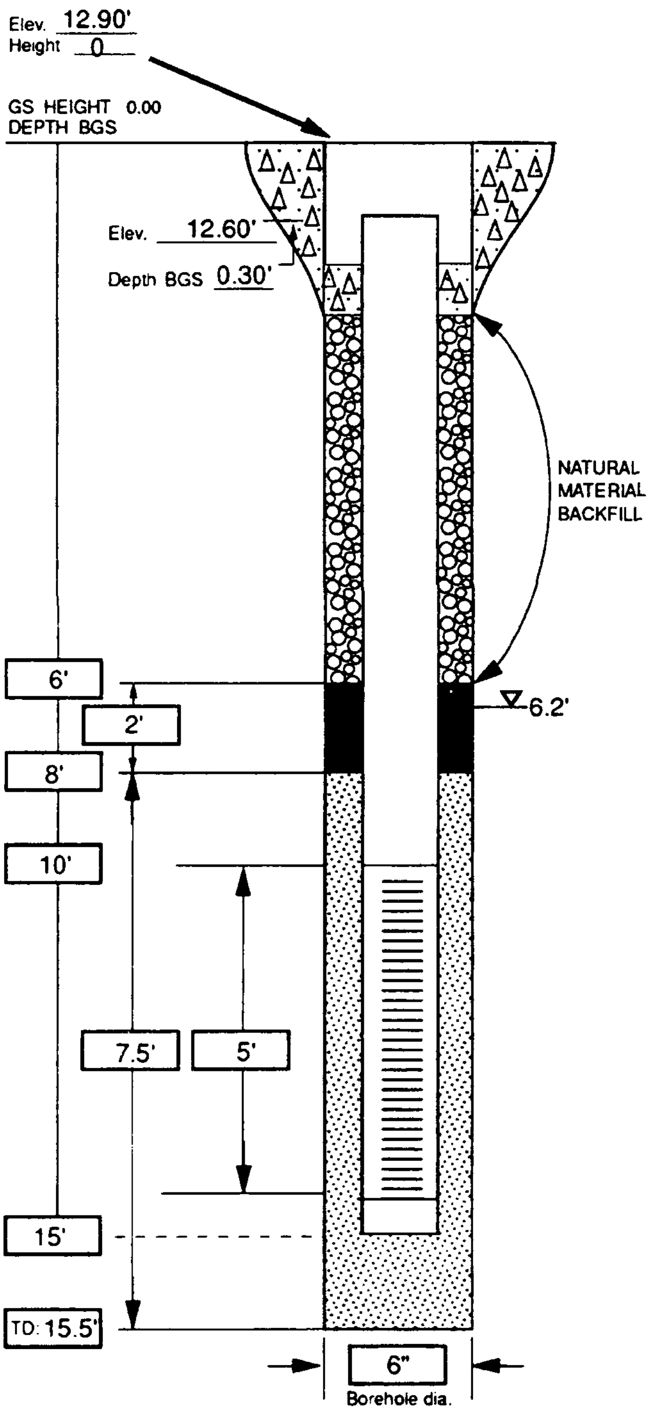
Client/Project: Georgia Air National Guard
Date: 6/30/90

Installation: Savannah
Site No. 5

HAZWRAP Contractor: CH2M HILL
Piezometer No. 05-PZ-01

Built by: R. Olson
Project No. SEF27794.C0

Drilling Contractor: E.E.I.
Comp Start: 10:20 am Comp. End: 12:30 pm



CONSTRUCTION METHOD

Augered / Driven: Augered

Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 7:38 pm)

RISER PIPE

Type: PVC Threaded Schedule - 40

Diameter: 1" Diameter

Total Length (TOC to TOS): 10'

GROUT

Composition & Proportions: 7 (80 # bags) Redi-Mix
3 quarts water per bag

Tremied (Y/N): N

Interval: Above 2' BGS

CENTRALIZERS (Y/N): N

Depth (s): N/A

SEAL

Type: Pelletized Bentonite - 25 pounds

Source: Polymer Drilling Services - Pel. Plug

Setup / Hydration time: 18 min. Vol. Fluid Added: none

Tremied (Y/N): N

FILTER PACK

Type: Silica Sand

Amt Used: 90 lbs.

Tremied (Y/N): N

Source: Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Threaded Schedule - 40

Diameter: 1"

Slot Size & Type: 10 Slot (0.010 inch) Factory Slot

Interval BGS: 10 - 15' BGS

SUMP (Y/N): N

Interval BGS: N/A Length: N/A

Bottom Cap (Y/N): Y Threaded

BACKFILL PLUG (Y/N): N

Material: N/A

Setup / Hydration time: N/A

Tremied (Y/N): N

PIEZOMETER CONSTRUCTION DETAIL

CH2M HILL

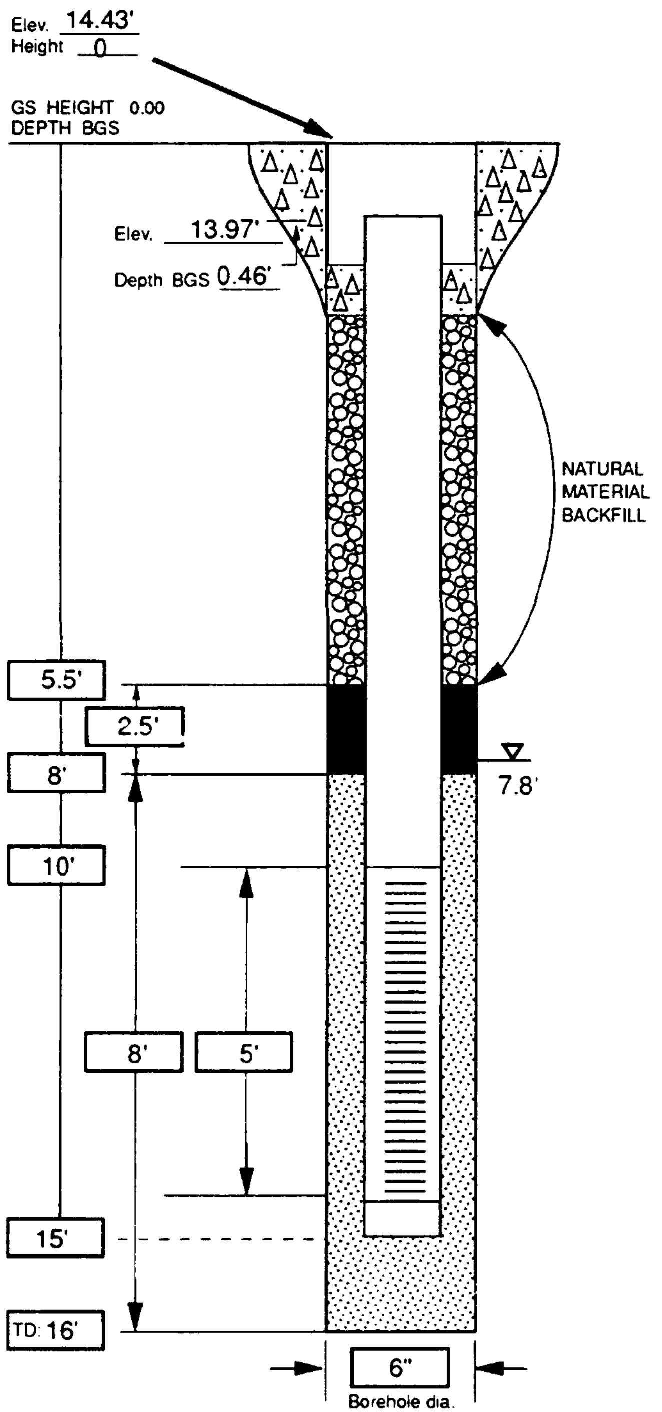
Client/Project: Georgia Air National Guard
Date: 6/30/90

Installation: Savannah
Site No. 5

HAZWRAP Contractor: CH2M HILL
Piezometer No. 05 - PZ - 02

Built by: R. Olson
Project No. SEF27794.C0

Drilling Contractor E.E.I.
Comp Start: 11:05 am Comp. End: 1:52 pm



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 8:15 pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 10'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup / Hydration time 20 min. Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 1 bag - 100 lbs.

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 10 - 15' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

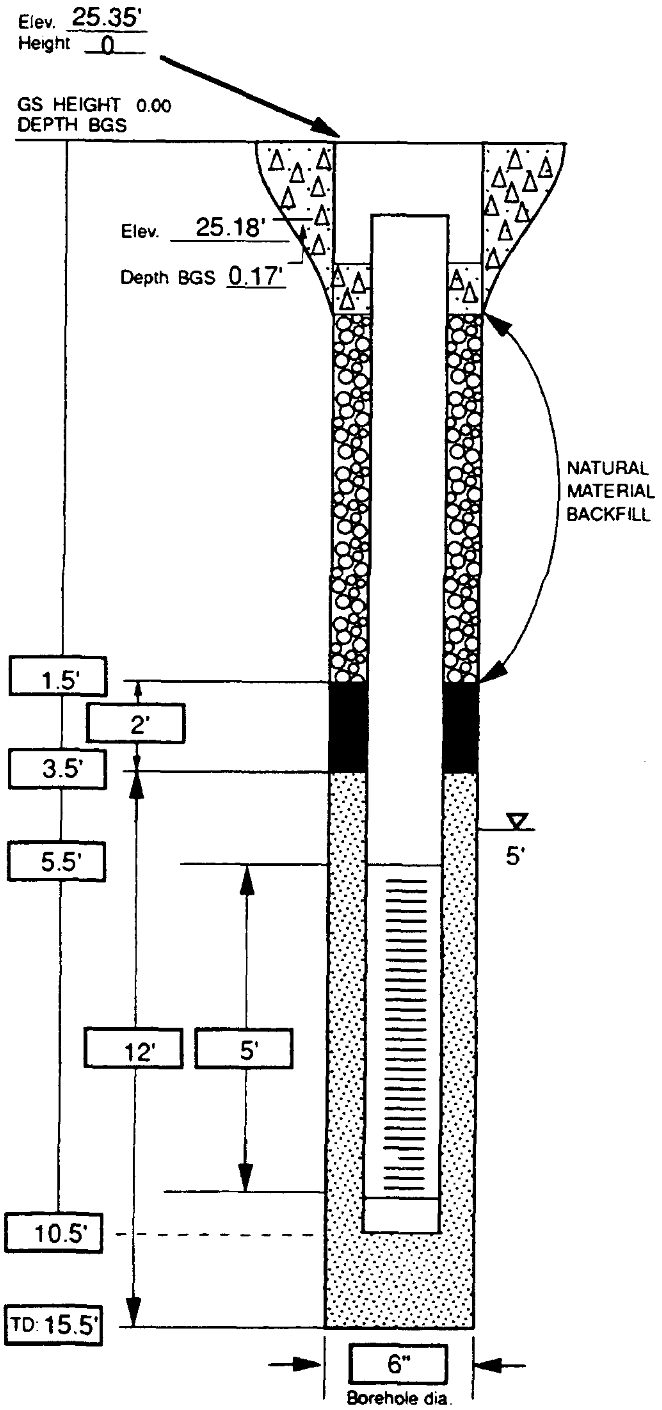
Client/Project: Georgia Air National Guard — Date 7/2/90

Installation: Savannah — Site No. 6

HAZWRAP Contractor: CH2M HILL — Piezometer No. 06-PZ-01

Built by: R. Olson — Project No. SEF27794.C0

Drilling Contractor E.E.I. — Comp Start: 1:30 pm Comp. End: 4:10 pm



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (Completed 7/5 12:20 pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 5.5'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup / Hydration time 1 hr Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 1.5 bags (150 lbs)

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 5.5 - 10.5' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

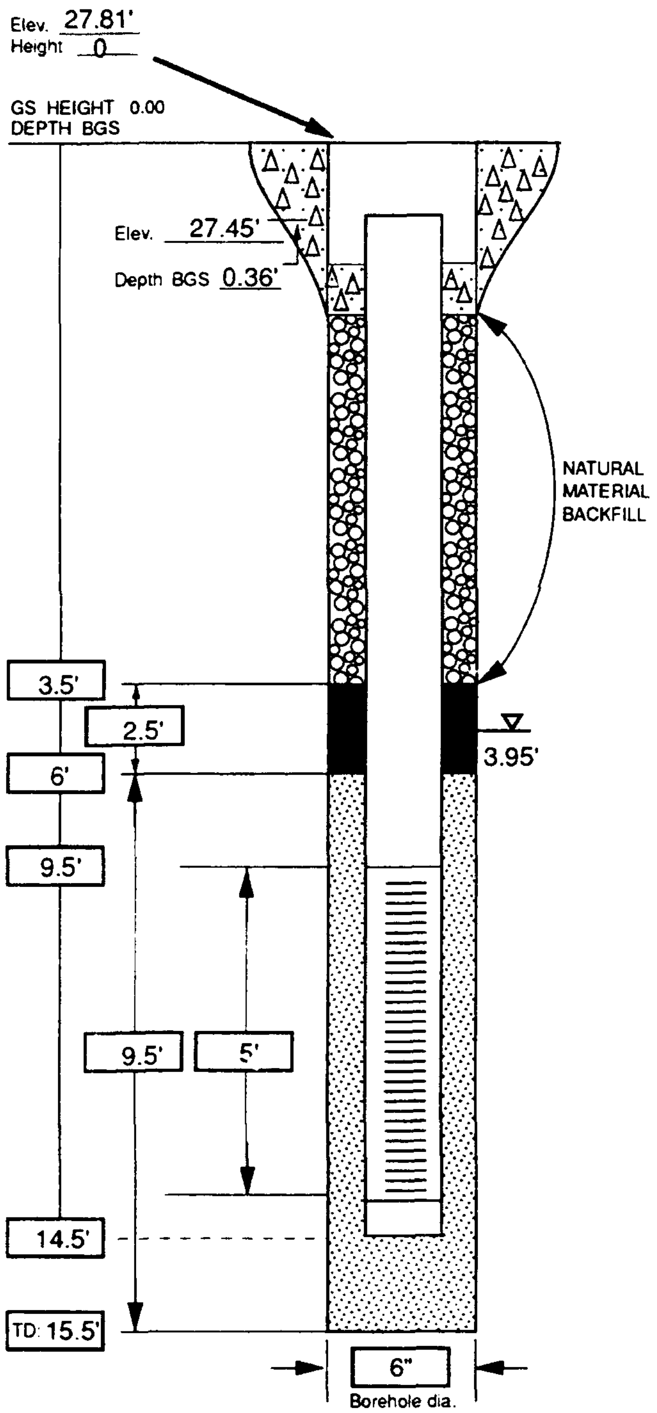
Client/Project: Georgia Air National Guard
Date: 7/2/90

Installation: Savannah
Site No.: 6

HAZWRAP Contractor: CH2M HILL
Piezometer No.: 06-PZ-02

Built by: R. Olson
Project No.: SEF27794.C0

Drilling Contractor: E.E.I.
Comp Start: 2:00 pm
Comp. End: 4:20 pm



CONSTRUCTION METHOD

Augered / Driven: Augered

Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 11:30 am)

RISER PIPE

Type: PVC Threaded Schedule - 40

Diameter: 1" Diameter

Total Length (TOC to TOS): 9.5'

GROUT

Composition & Proportions: 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N): N

Interval: Abov 2' BGS

CENTRALIZERS (Y/N): N

Depth (s): N/A

SEAL

Type: Pelletized Bentonite - 25 pounds

Source: Polymer Drilling Services - Pel. Plug

Setup / Hydration time: 1.20 hr
Vol. Fluid Added: none

Tremied (Y/N): N

FILTER PACK

Type: Silica Sand

Amt Used: 120 lbs

Tremied (Y/N): N

Source: Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Threaded Schedule - 40

Diameter: 1"

Slot Size & Type: 10 Slot (0.010 inch) Factory Slot

Interval BGS: 9.5 - 14.5' BGS

SUMP (Y/N): N

Interval BGS: N/A
Length: N/A

Bottom Cap (Y/N): Y Threaded

BACKFILL PLUG (Y/N): N

Material: N/A

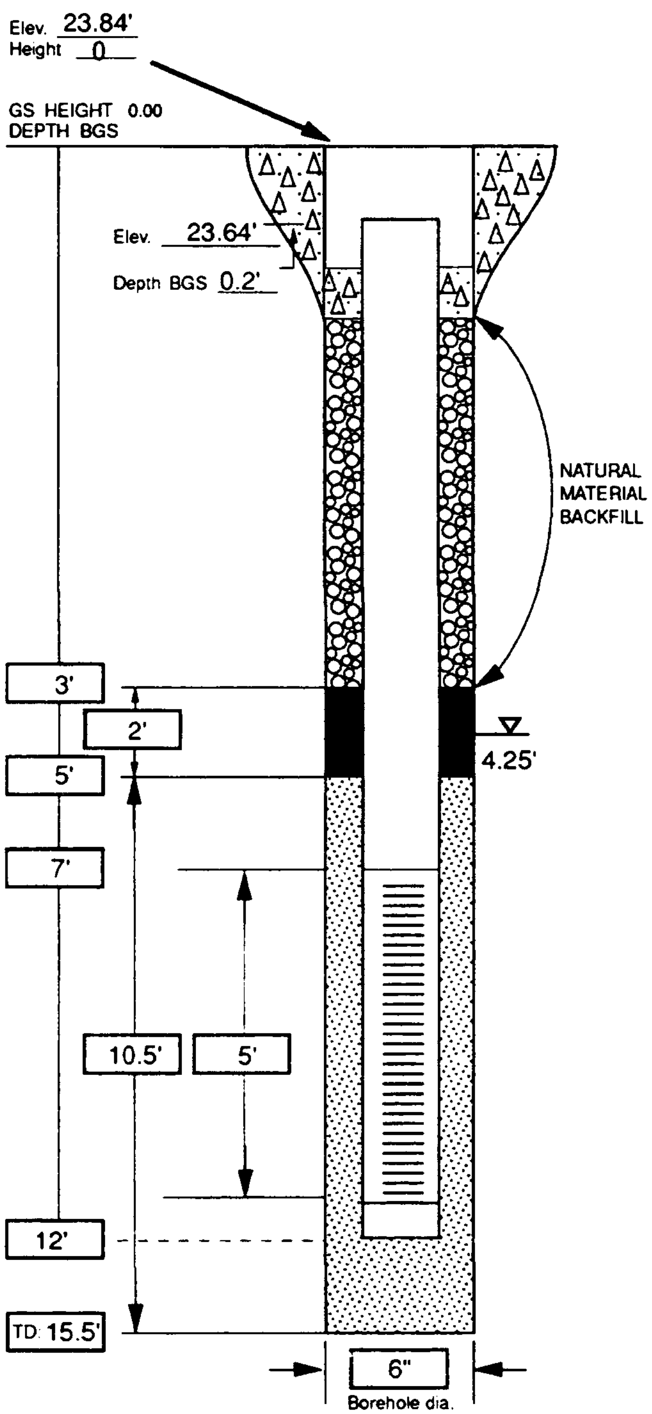
Setup / Hydration time: N/A

Tremied (Y/N): N

PIEZOMETER CONSTRUCTION DETAIL

CH2M HILL

Client/Project: Georgia Air National Guard
Date: 7/2/90
Installation: Savannah
Site No.: 7
HAZWRAP Contractor: CH2M HILL
Piezometer No.: 07-PZ-01
Built by: R. Olson
Project No.: SEF27794.C0
Drilling Contractor: E.E.I.
Comp Start: 11:04 am Comp. End: 12:02 pm



CONSTRUCTION METHOD

Augered / Driven: Augered
Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 1:10 pm)

RISER PIPE

Type: PVC Threaded Schedule - 40
Diameter: 1" Diameter
Total Length (TOC to TOS): 7'

GROUT

Composition & Proportions: 7 (80# Bag) Redi-Mix
3 quarts water per bag
Tremied (Y/N) N
Interval: Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s): N/A

SEAL

Type: Pelletized Bentonite - 25 pounds
Source: Polymer Drilling Services - Pel. Plug
Setup / Hydration time: 20 min. Vol. Fluid Added: none
Tremied (Y/N) N

FILTER PACK

Type: Silica Sand
Amt Used: 80 lbs.
Tremied (Y/N) N
Source: Morie Co - Industrial Sand - Ga. Silica Division
Gr. Size Dist.: 20/40

SCREEN

Type: PVC Threaded Schedule - 40
Diameter: 1"
Slot Size & Type: 10 Slot (0.010 inch) Factory Slot
Interval BGS: 7 - 12' BGS

SUMP (Y/N) N

Interval BGS: N/A Length: N/A
Bottom Cap (Y/N) Y: Threaded

BACKFILL PLUG (Y/N) N

Material: N/A
Setup / Hydration time: N/A
Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

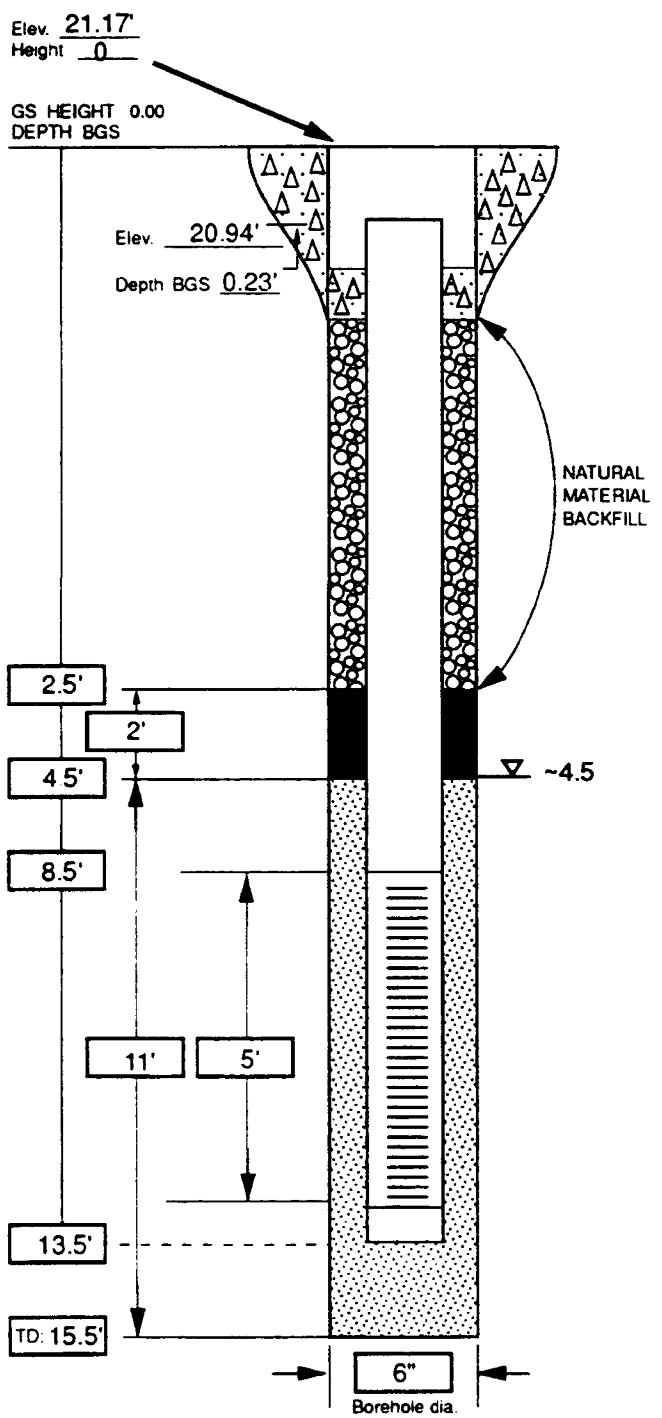
Client/Project: Georgia Air National Guard
Date: 7/2/90

Installation: Savannah
Site No. 9

HAZWRAP Contractor: CH2M HILL
Piezometer No. 09-PZ-01

Built by: R. Olson
Project No. SEF27794.C0

Drilling Contractor: E.E.I.
Comp Start: 7:48 am Comp. End: 9:56 am



CONSTRUCTION METHOD

Augered / Driven: Augered
Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 6:20 pm)

RISER PIPE

Type: PVC Threaded Schedule - 40
Diameter: 1" Diameter
Total Length (TOC to TOS): 8.5'

GROUT

Composition & Proportions: 7 (80# Bag) Redi-Mix
3 quarts water per bag
Tremied (Y/N): N
Interval: Above 2' BGS

CENTRALIZERS (Y/N): N
Depth (s): N/A

SEAL

Type: Granular Bentonite - 50 pounds
Source: N.L. Petroleum Services, Inc. - Hole Plug
Setup / Hydration time: 30 min. Vol. Fluid Added: 2 gal.
Tremied (Y/N): N

FILTER PACK

Type: Silica Sand
Amt Used: 1 bag - 100 lbs.
Tremied (Y/N): N
Source: Morie Co - Industrial Sand - Ga. Silica Division
Gr. Size Dist.: 20/40

SCREEN

Type: PVC Threaded Schedule - 40
Diameter: 1"
Slot Size & Type: 10 Slot (0.010 inch) Factory Slot
Interval BGS: 8.5 - 13.5' BGS

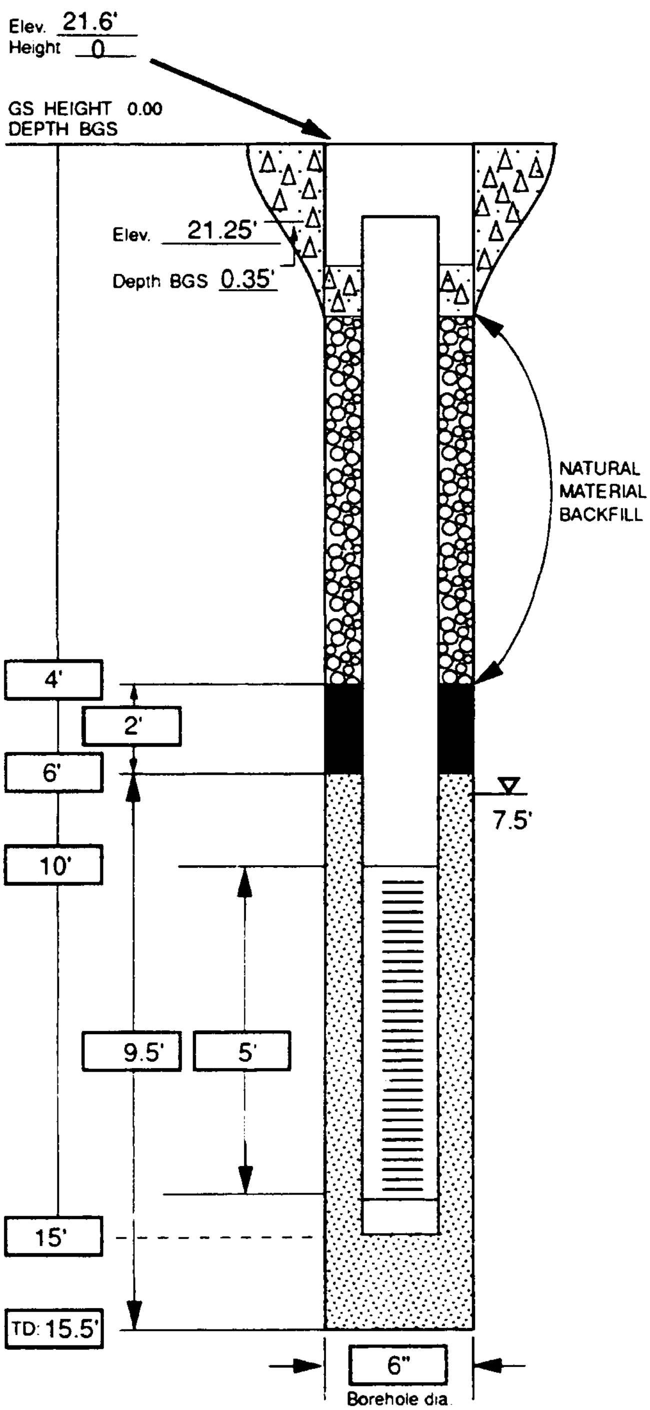
SUMP (Y/N): N
Interval BGS: N/A Length: N/A
Bottom Cap (Y/N): Y Threaded

BACKFILL PLUG (Y/N): N
Material: N/A
Setup / Hydration time: N/A
Tremied (Y/N): N

PIEZOMETER CONSTRUCTION DETAIL

CH2M HILL

Client/Project: Georgia Air National Guard
Date: 7/2/90
Installation: Savannah
Site No. 9
HAZWRAP Contractor: CH2M HILL
Piezometer No. 09-PZ-02
Built by: R. Olson
Project No. SEF27794.C0
Drilling Contractor: E.E.I.
Comp Start: 8:25 am   Comp. End: 10:08 am



CONSTRUCTION METHOD

Augered / Driven: Augered
Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 4:35 pm)

RISER PIPE

Type: PVC Threaded Schedule - 40
Diameter: 1" Diameter
Total Length (TOC to TOS): 10'

GROUT

Composition & Proportions: 7 (80# Bag) Redi-Mix
3 quarts water per bag
Tremied (Y/N): N
Interval: Above 2' BGS

CENTRALIZERS (Y/N): N
Depth (s): N/A

SEAL

Type: Granular Bentonite - 50 pounds
Source: N.L. Petroleum Services, Inc. - Hole Plug
Setup / Hydration time: 25 min. Vol. Fluid Added: 2 gal.
Tremied (Y/N): N

FILTER PACK

Type: Silica Sand
Amt Used: 1 bag - 100 lbs.
Tremied (Y/N): N
Source: Morie Co - Industrial Sand - Ga. Silica Division
Gr. Size Dist. 20/40

SCREEN

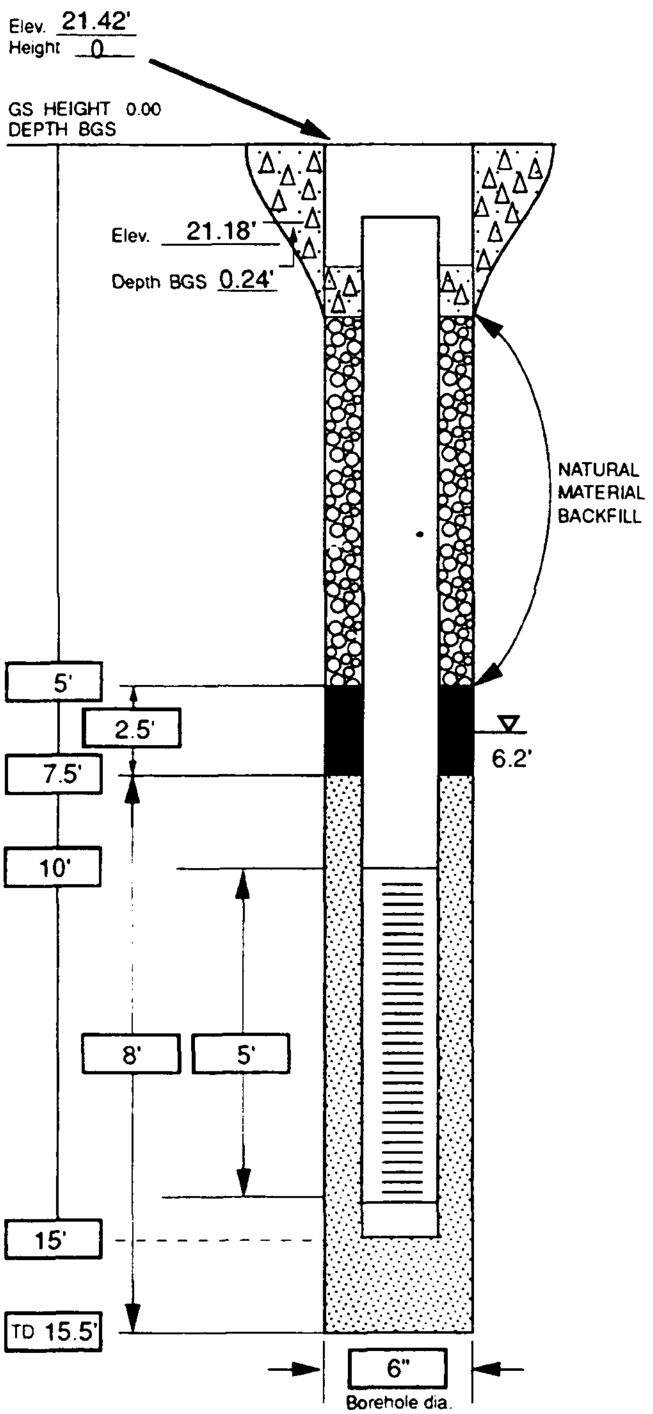
Type: PVC Threaded Schedule - 40
Diameter: 1"
Slot Size & Type: 10 Slot (0.010 inch) Factory Slot
Interval BGS: 10 - 15' BGS

SUMP (Y/N): N
Interval BGS: N/A   Length: N/A
Bottom Cap (Y/N): Y   Threaded

BACKFILL PLUG (Y/N): N
Material: N/A
Setup / Hydration time: N/A
Tremied (Y/N): N

PIEZOMETER CONSTRUCTION DETAIL

Client/Project: Georgia Air National Guard
Date 7/2/90
Installation: Savannah
Site No. 9
HAZWRAP Contractor: CH2M HILL
Piezometer No. 09-PZ-03
Built by: R. Olson
Project No. SEF27794.C0
Drilling Contractor E.E.I.
Comp Start: 8:55 am Comp. End: 9:46 am



CONSTRUCTION METHOD

Augered / Driven Augered
Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/5 5:46 pm)

RISER PIPE

Type PVC Threaded Schedule - 40
Diameter 1" Diameter
Total Length (TOC to TOS) 10'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag
Tremied (Y/N) N
Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Pelletized Bentonite - 25 pounds
Source Polymer Drilling Services - Pel. Plug
Setup / Hydration time 30 min. Vol. Fluid Added none
Tremied (Y/N) N

FILTER PACK

Type Silica Sand
Amt Used 80 lbs.
Tremied (Y/N) N
Source Morie Co - Industrial Sand - Ga. Silica Division
Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40
Diameter 1"
Slot Size & Type 10 Slot (0.010 inch) Factory Slot
Interval BGS 10 - 15' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A
Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A
Setup / Hydration time N/A
Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

Client/Project: Georgia Air National Guard

Installation: Savannah

HAZWRAP Contractor: CH2M HILL

Built by: R. Olson

Drilling Contractor: E.E.I.

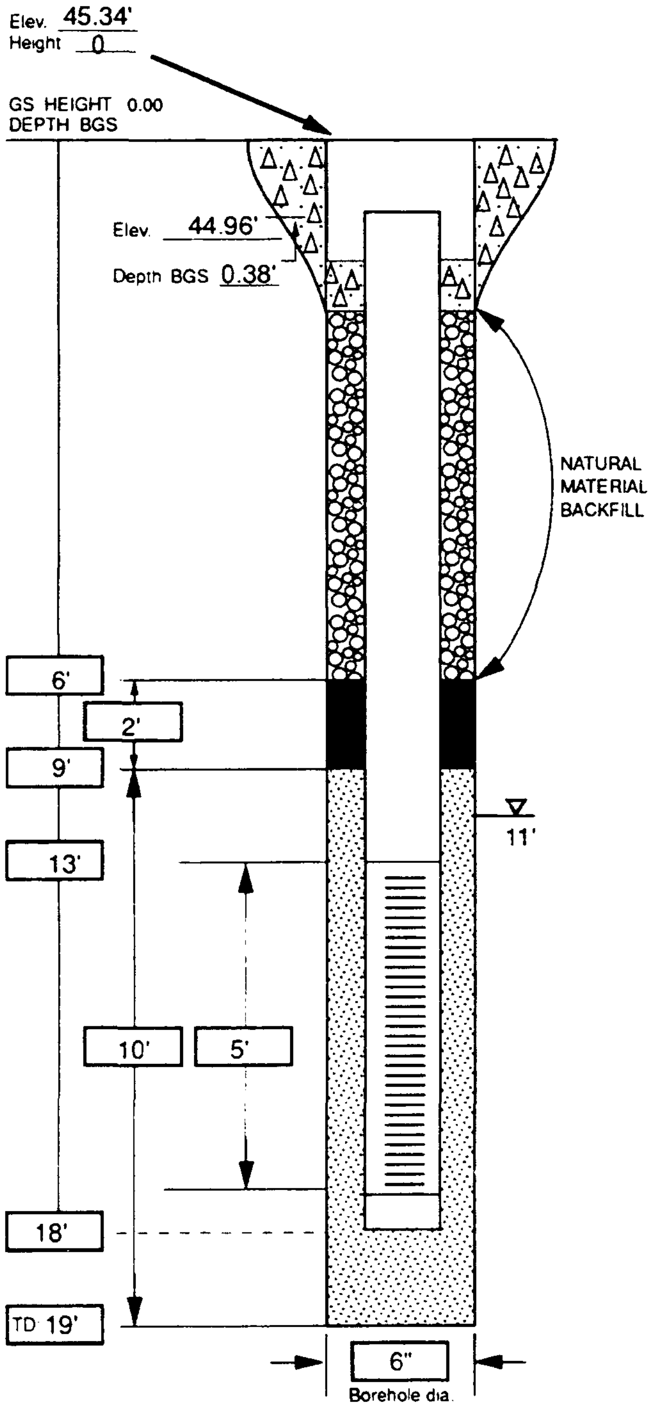
Date: 7/3/90 and 7/4/90

Site No.: 10

Piezometer No.: 10-PZ-01

Project No.: SEF27794.C0

Comp Start: 4:45 pm Comp. End: 11:20 pm



CONSTRUCTION METHOD

Augered / Driven: Augered

Equipment Used: Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/4 4:10 pm)

RISER PIPE

Type: PVC Threaded Schedule - 40

Diameter: 1" Diameter

Total Length (TOC to TOS): 0 - 13'

GROUT

Composition & Proportions: 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N): N

Interval: Above 2' BGS

CENTRALIZERS (Y/N): N

Depth (s): N/A

SEAL

Type: Granular Bentonite - 75 pounds

Source: N.L. Petroleum Services - Hole Plug

Setup / Hydration time: 70 min Vol. Fluid Added: 2 gal.

Tremied (Y/N): N

FILTER PACK

Type: Silica Sand

Amt Used: 150 lbs

Tremied (Y/N): N

Source: Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Threaded Schedule - 40

Diameter: 1"

Slot Size & Type: 10 Slot (0.010 inch) Factory Slot

Interval BGS: 13 - 18' BGS

SUMP (Y/N): N

Interval BGS: N/A Length: N/A

Bottom Cap (Y/N): Y Threaded

BACKFILL PLUG (Y/N): N

Material: N/A

Setup / Hydration time: N/A

Tremied (Y/N): N

PIEZOMETER CONSTRUCTION DETAIL

CH2M HILL

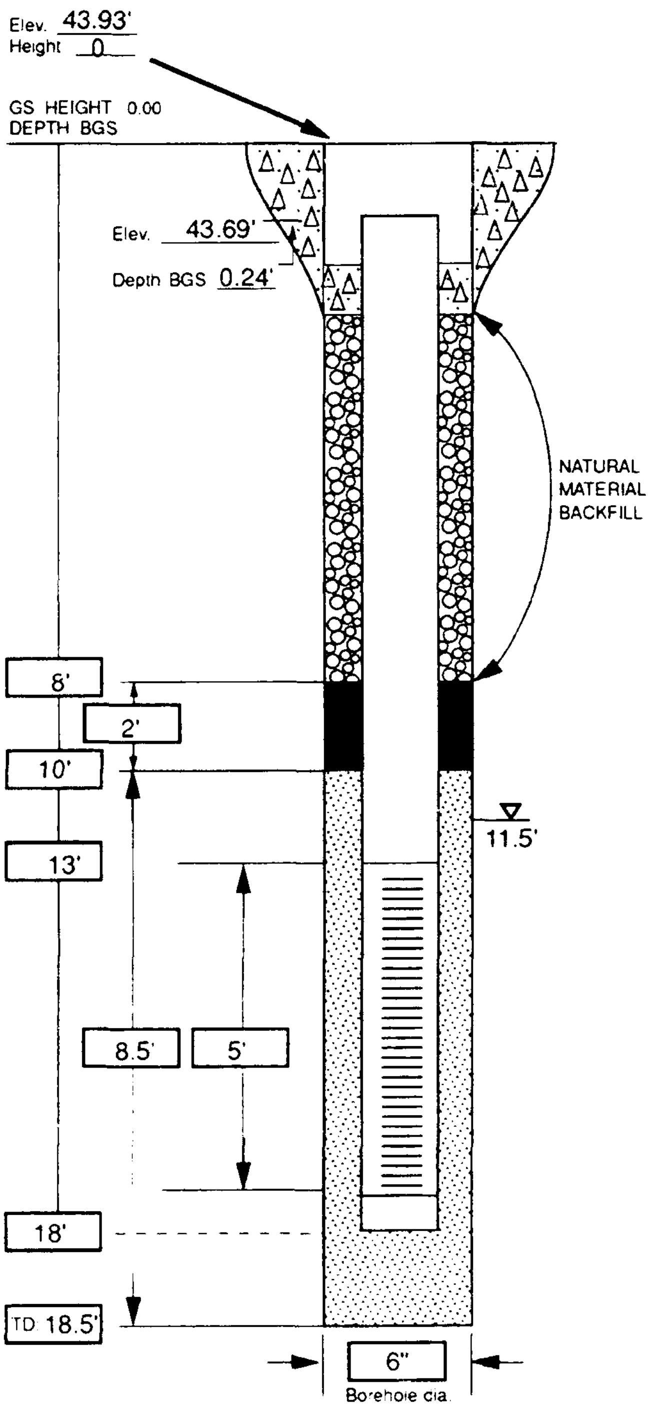
Client/Project: Georgia Air National Guard
Date 7/3/90 and 7/4/90

Installation: Savannah
Site No. 10

HAZWRAP Contractor: CH2M HILL
Piezometer No. 10-PZ-02

Built by: R. Olson
Project No. SEF27794.C0

Drilling Contractor E.E.I.
Comp Start: 5:50 pm Comp. End: 11:20 am



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete Pad
10" Dia. Well Box (completed 7/4 4:45 pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 0 - 12'

GROUT

Composition & Proportions 7 (80# Bag) Redi-Mix
3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services - Hole Plug

Setup / Hydration time 55 min Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 150 lbs

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 13 - 18' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

PIEZOMETER CONSTRUCTION DETAIL

Client/Project: Georgia Air National Guard

Date 7/4/90

Installation: Savannah

Site No. 10

HAZWRAP Contractor: CH2M HILL

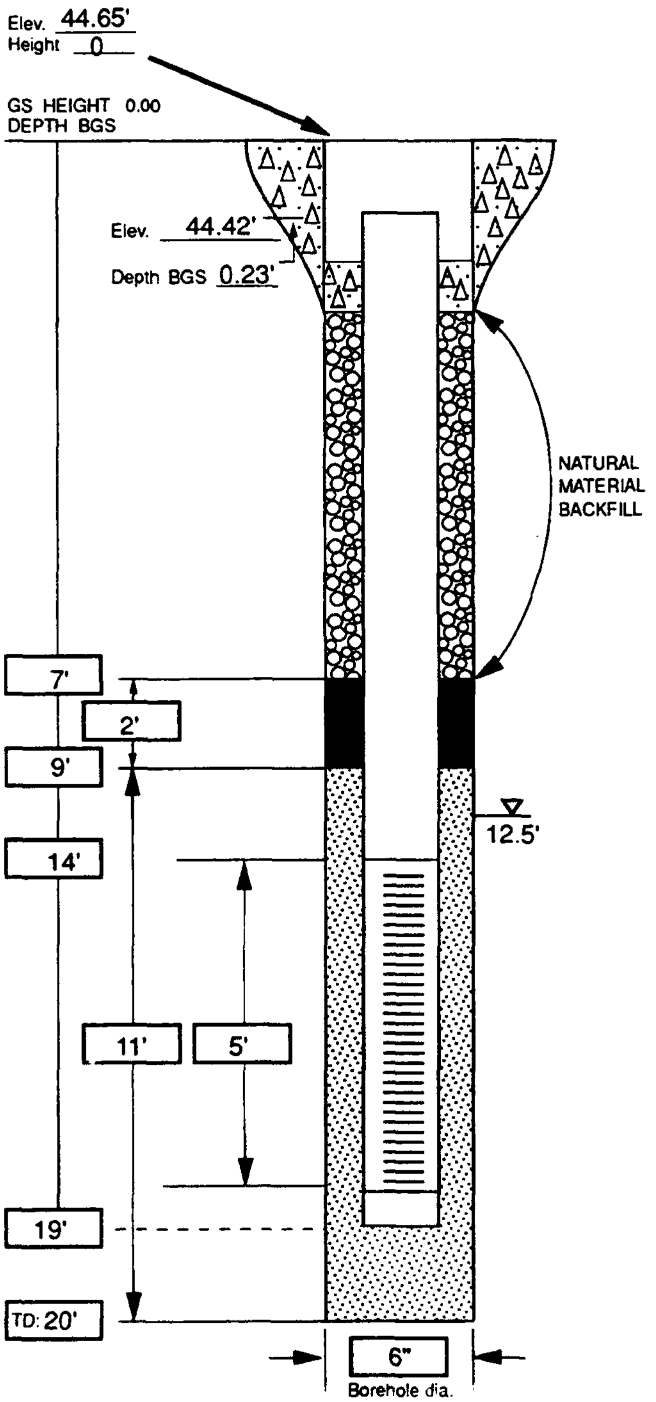
Piezometer No. 10-PZ-03

Built by: R. Olson

Project No. SEF27794.C0

Drilling Contractor E.E.I.

Comp Start: 9:48 pm Comp. End: 11:30 am



CONSTRUCTION METHOD

Augered / Driven Augered

Equipment Used Mobil Drill B-57 / Augers

SURFACE PAD

Composition & Size 12" Diameter - Flush mount in taxiway 10" Dia. Well Box (completed 7/4 4:30 pm)

RISER PIPE

Type PVC Threaded Schedule - 40

Diameter 1" Diameter

Total Length (TOC to TOS) 0 - 14'

GROUT

Composition & Proportions 1 (80# Bag) Redi-Mix 3 quarts water per bag

Tremied (Y/N) N

Interval Above 2' BGS

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite - 50 pounds

Source N.L. Petroleum Services - Hole Plug

Setup / Hydration time 20 min. Vol. Fluid Added 2 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 150 lbs

Tremied (Y/N) N

Source Morie Co - Industrial Sand - Ga. Silica Division

Gr. Size Dist. 20/40

SCREEN

Type PVC Threaded Schedule - 40

Diameter 1"

Slot Size & Type 10 Slot (0.010 inch) Factory Slot

Interval BGS 14' - 19' BGS

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y Threaded

BACKFILL PLUG (Y/N) N

Material N/A

Setup / Hydration time N/A

Tremied (Y/N) N

Monitor Wells

CH2M HILL

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 8/29/90

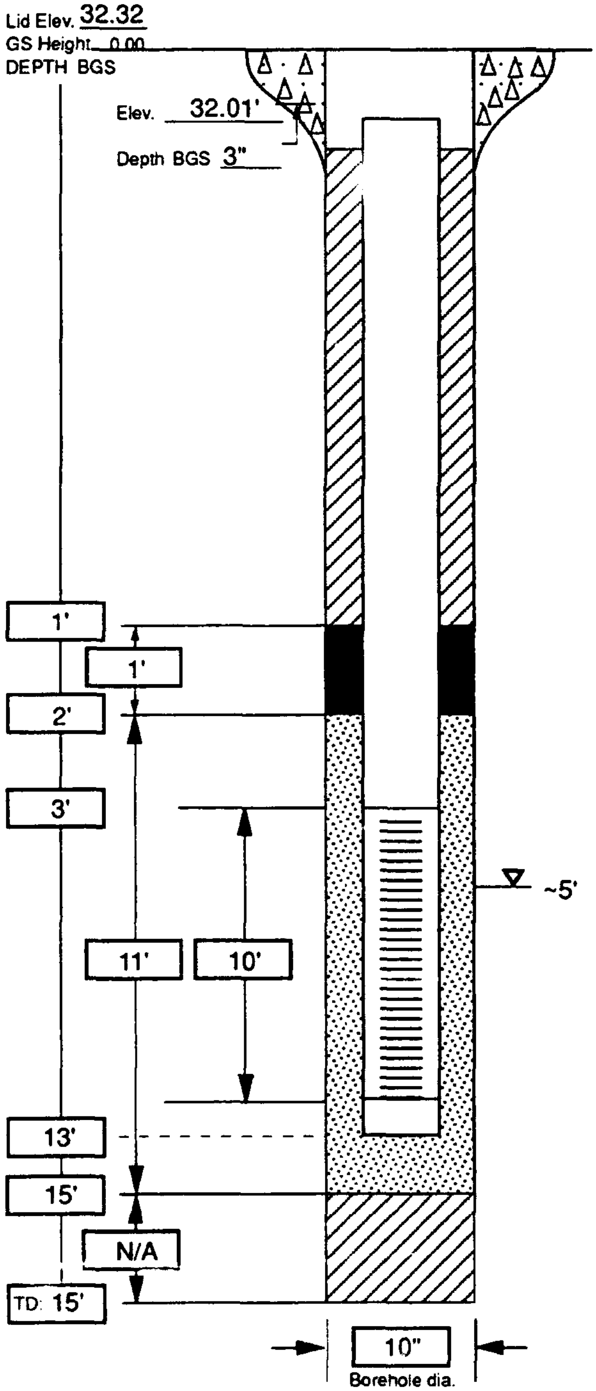
Client/Project: MMES / Savannah
Site No. No. 1

Installation: Georgia Air National Guard
Well No. 01-MW-01

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0

Built by: R. Olson
Comp Start: 4:25 pm

Drilling Contractor: E.E.I. /Turner
Comp. End: 5:30 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 8/30/90)

Diameter 10" Water Tight Seal (Y/N) — Y circled

Depth BGS 5.5" Weep hole (Y/N) — Y circled

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) — N circled

Interval 0 - 1'

CENTRALIZERS (Y/N) — N circled

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 24 hrs Vol. Fluid Added 5 gal.

Tremied (Y/N) — N circled

FILTER PACK

Type Silica Sand

Amt Used 8.5 - 100 pound bags

Tremied (Y/N) — N circled

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type Factory Slot

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 3' - 13'

SUMP (Y/N) — N circled

Interval BGS N/A Length N/A

Bottom Cap (Y/N) — Y circled N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N) — N circled

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 8/29/90

Client/Project: MMES / Savannah

Site No. No. 1

Installation: Georgia Air National Guard

Well No. 01-MW-02

HAZWRAP Contractor: CH2M HILL

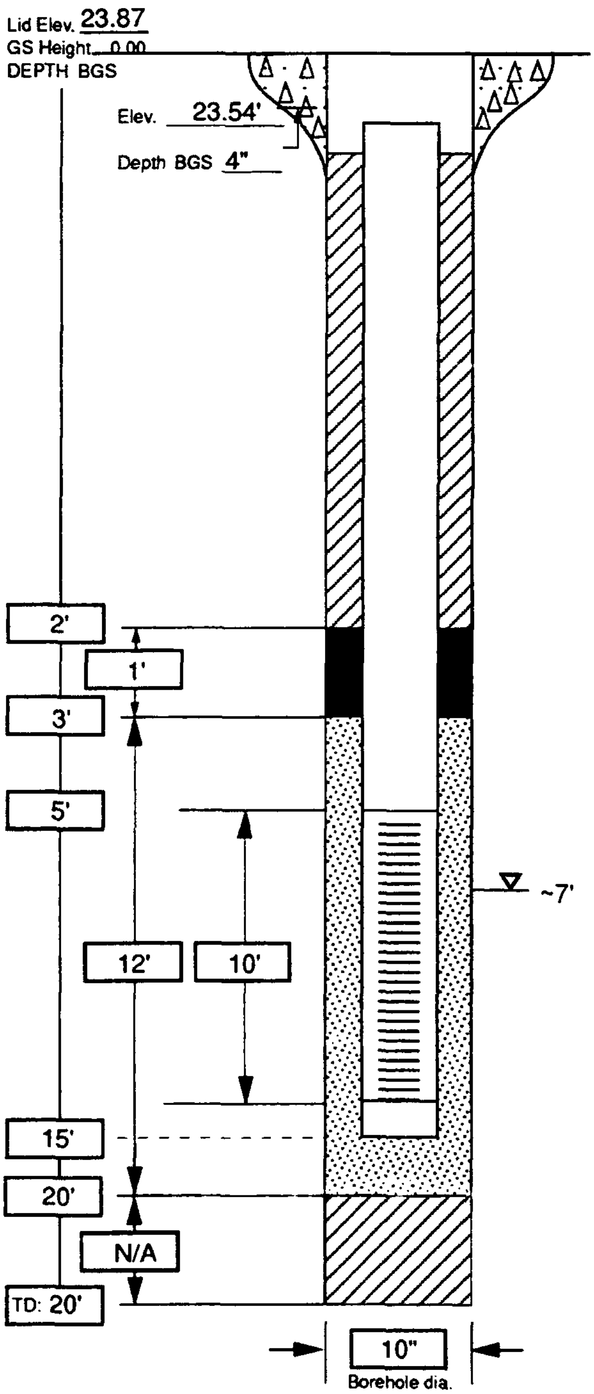
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 10:04 am

Drilling Contractor: E.E.I. /Turner

Comp. End: 12:17 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 8/30/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 5.5" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 5'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 2'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time days Vol. Fluid Added 8 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 8.5 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type Factory Slot

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 5' - 15'

SUMP (Y /N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 8/31/90

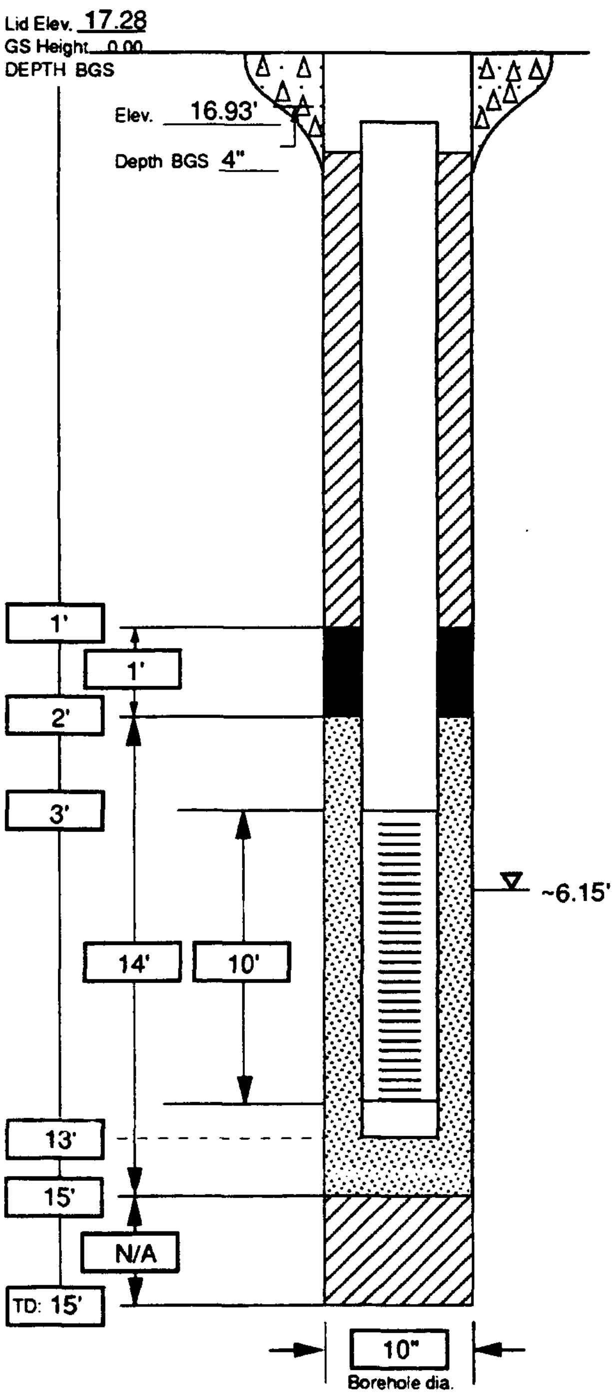
Client/Project: MMES / Savannah | Site No. No. 2

Installation: Georgia Air National Guard | Well No. 02-MW-01

HAZWRAP Contractor: CH2M HILL | Project No. SEF27794.C0

Built by: R. Olson | Comp Start: 8:48 am

Drilling Contractor: E.E.I. /Turner | Comp. End: 9:45 am



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 5" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 1'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 11 days Vol. Fluid Added ~10 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 6.5 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No.10 (0.010 inch) Factory Slot

Interval BGS 3 - 13 '

SUMP (Y /N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/9/90

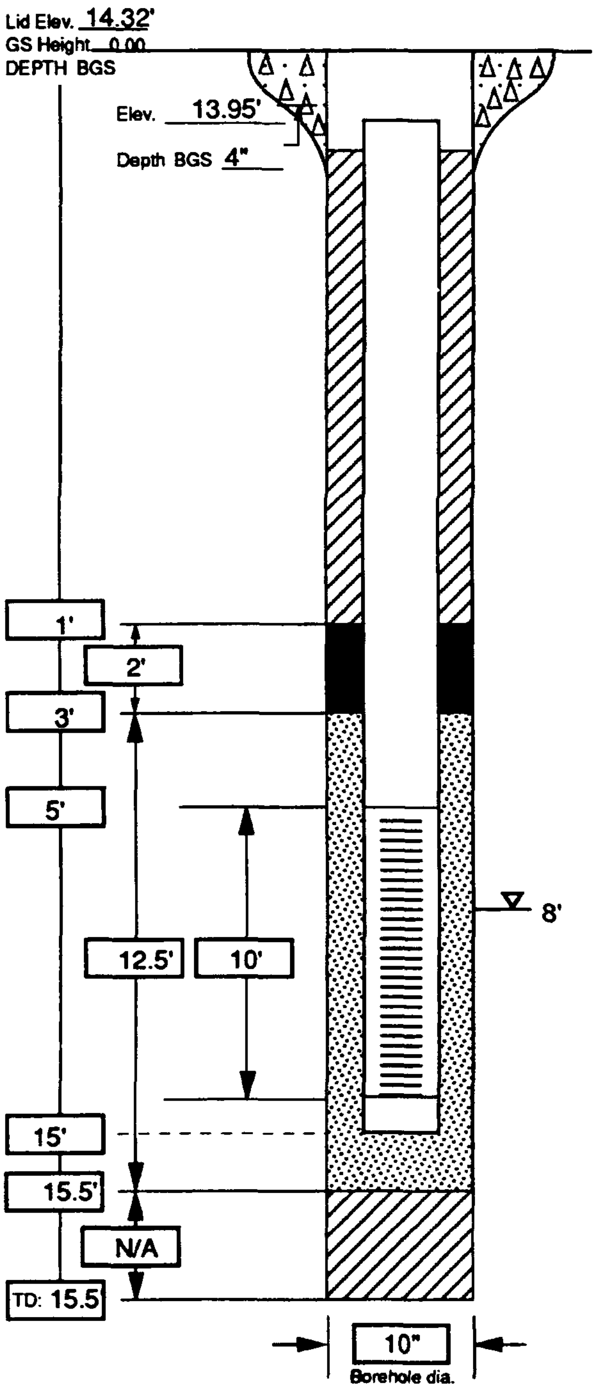
Client/Project: MMES / Savannah
Site No. No. 5

Installation: Georgia Air National Guard
Well No. 05-MW-01

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0

Built by: R. Olson
Comp Start: 4:46 pm

Drilling Contractor: E.E.I. /Turner
Comp. End: 5:45 pm



PROTECTIVE CSG

Material/Type: Steel Flush Mount (Installed 9/11/90)

Diameter: 10" Water Tight Seal (Y/N)

Depth BGS: 5" Weep hole (Y/N)

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete

RISER PIPE

Type: PVC Theaded Schedule - 40

Diameter: 2" Diameter

Total Length (TOC to TOS): 5'

GROUT

Composition & Proportions: 7 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval: 0 - 1'

CENTRALIZERS (Y/N)

Depth (s): N/A

SEAL

Type: Granular Bentonite

Source: N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time: 48 hrs Vol. Fluid Added: 20 gal.

Tremied (Y/N)

FILTER PACK

Type: Silica Sand

Amt Used: 5.5 -100 pound bags

Tremied (Y/N)

Source: Foster Dixiana

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Theaded Schedule - 40

Diameter: 2 inch diameter

Slot Size & Type: No. 10 (0.010 inch) Factory Slot

Interval BGS: 5' - 15'

SUMP (Y/N)

Interval BGS: N/A Length: N/A

Bottom Cap (Y/N): N/A

BACKFILL PLUG

Material: N/A

Steup /Hydration Time: N/A

Tremied (Y/N)

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/9/90

Client/Project: MMES / Savannah

Site No. No. 5

Installation: Georgia Air National Guard

Well No. 05-MW-02

HAZWRAP Contractor: CH2M HILL

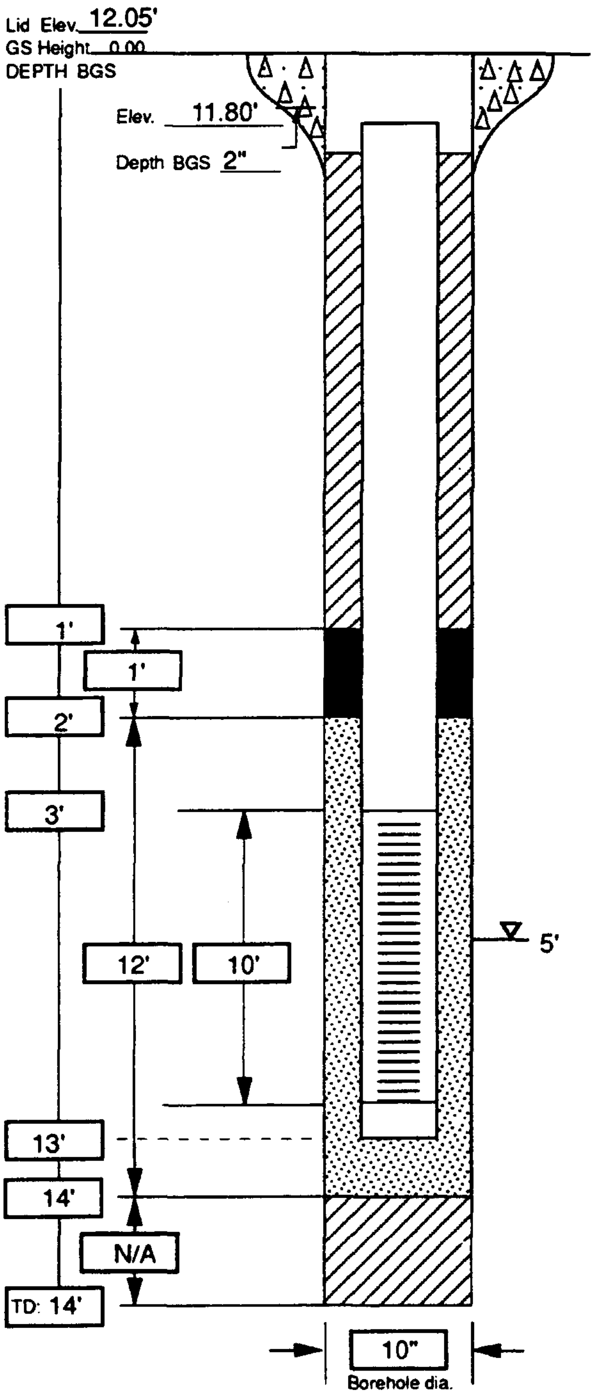
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 11:26 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 12:00 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N) — Y

Depth BGS 5" Weep hole (Y/N) — Y

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons water per bag

Tremied (Y/N) — N

Interval 0 - 1'

CENTRALIZERS (Y/N) — N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 48 hrs Vol. Fluid Added 10 gal.

Tremied (Y/N) — N

FILTER PACK

Type Silica Sand

Amt Used 5.5 - 100 pound bags

Tremied (Y/N) — N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 3' - 13'

SUMP (Y/N) — N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) — Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N) — N

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/9/90

Client/Project: MMES / Savannah

Site No. No. 5

Installation: Georgia Air National Guard

Well No. 05-MW-03

HAZWRAP Contractor: CH2M HILL

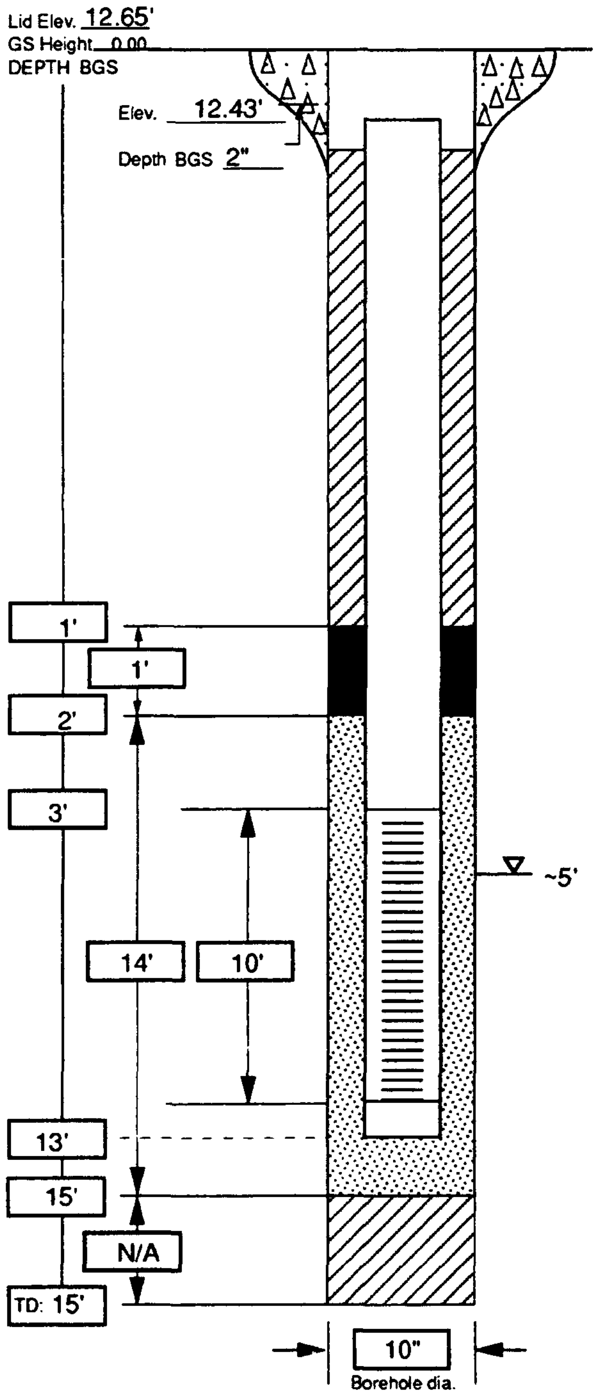
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 2:31 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 3:28 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 6" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 7 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 1'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 48 hrs Vol. Fluid Added 10 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 6 -100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 3' - 13'

SUMP (Y / N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

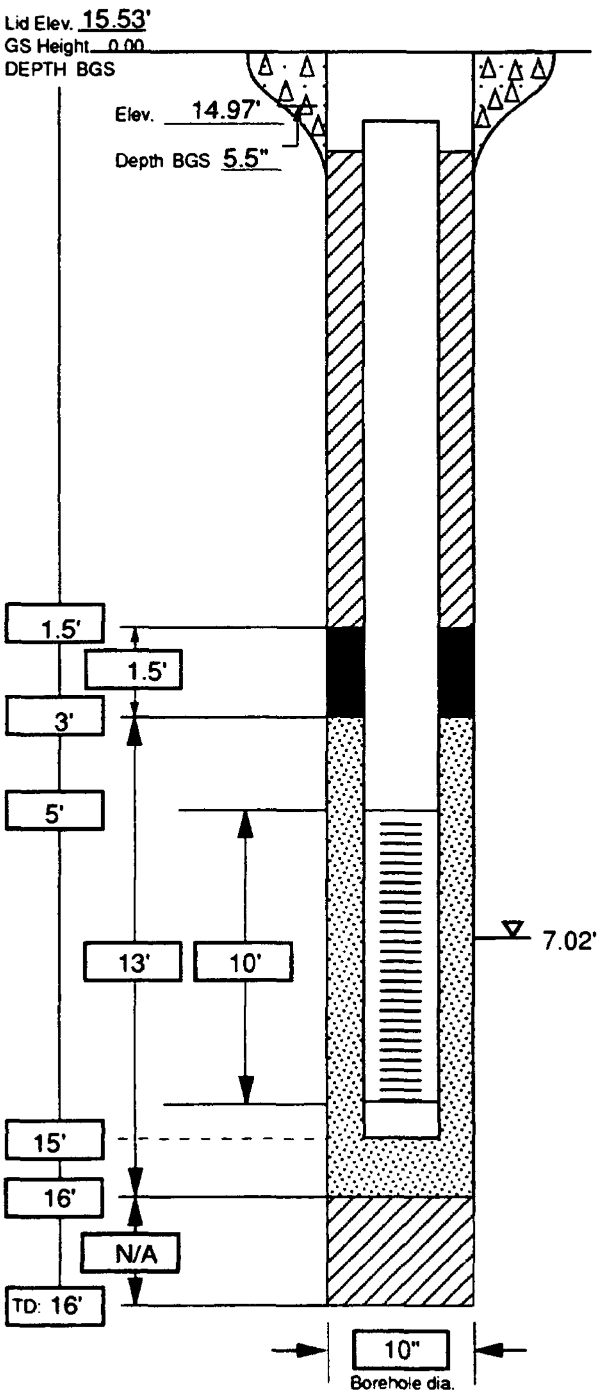
Steup /Hydration Time N/A

Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/10/90

Client/Project: MMES / Savannah
Site No. No. 5
Installation: Georgia Air National Guard
Well No. 05-MW-04
HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0
Built by: R. Olson
Comp Start: 9:22 am
Drilling Contractor: E.E.I. /Turner
Comp. End: 10:35 am



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N) Y

Depth BGS 6" Weep hole (Y/N) Y

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 5'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) N

Interval 0 - 1.5'

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 24 hrs Vol. Fluid Added 20 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 6 - 100 pound bags

Tremied (Y/N) N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 5' - 15'

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N) N

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 8/31/90

Client/Project: MMES / Savannah
Site No. No. 6

Installation: Georgia Air National Guard
Well No. 06-MW-01

HAZWRAP Contractor: CH2M HILL
Project No.

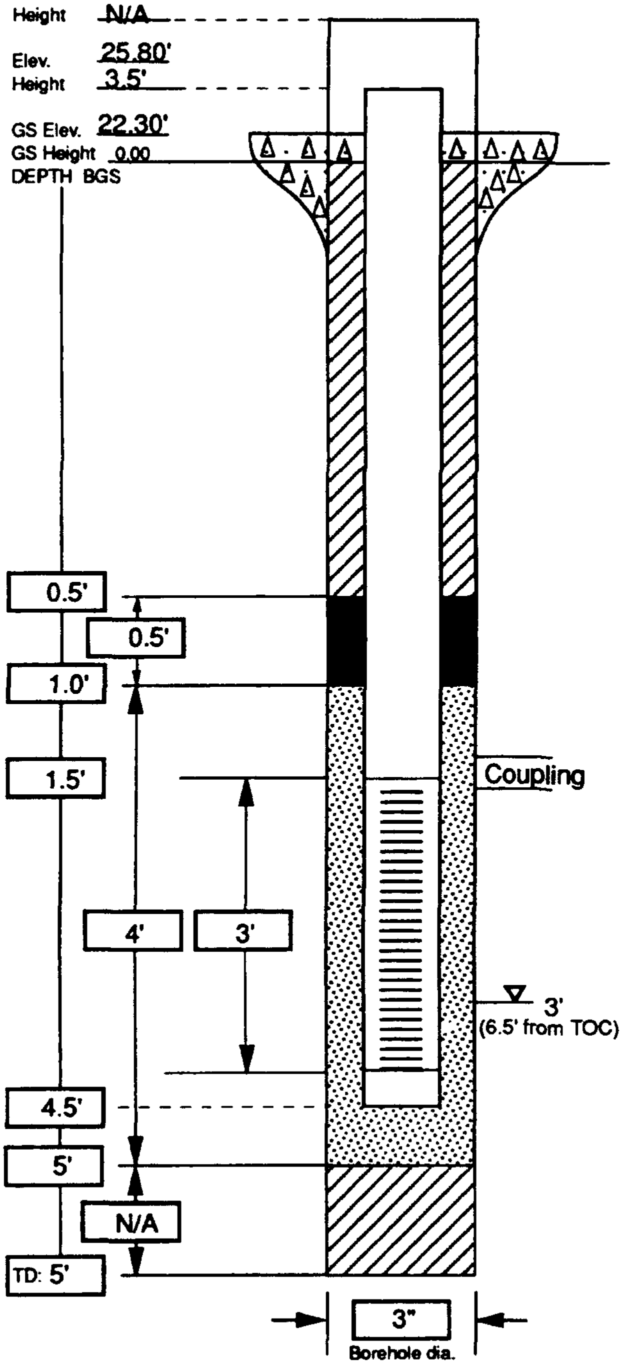
Built by: R. Olson
Comp Start: 1:20 pm

Drilling Contractor: E.E.I. / Turner
Comp. End: 2:00 pm

Elev. N/A
Height N/A

Elev. 25.80'
Height 3.5'

GS Elev. 22.30'
GS Height 0.00
DEPTH BGS



PROTECTIVE CSG
Material/Type N/A
Diameter N/A
Depth BGS N/A Weep hole (Y/N) N

GUARD POSTS (Y/N) N
No. N/A Type N/A

SURFACE PAD
Composition & Size 3' x 3' x 6' Concrete

RISER PIPE
Type Schedule - 40 Coupled PVC Casing
Diameter 2" Diameter
Total Length (TOC to TOS) 5'

GROUT
Composition & Proportions 6 (80#) bags Quickrete with 0.75 gallons of water per bag
Tremied (Y/N) N
Interval 0 - 1'

CENTRALIZERS (Y/N) N
Depth (s) N/A

SEAL
Type Granular Bentonite
Source N.L. Petroleum Services, Inc. - Hole Plug
Setup /Hydration Time hours Vol. Fluid Added 8 gal.
Tremied (Y /N) N

FILTER PACK
Type Silica Sand
Amt Used 200 pounds
Tremied (Y/N) N
Source Foster Dixiana
Gr. Size Dist. 20/40 Gradation

SCREEN
Type Factory Slot
Diameter 2 inch diameter
Slot Size & Type No. 10 (0.010 inch) Factory Slot
Interval BGS 1.5' - 3.5'

SUMP (Y /N) N
Interval BGS N/A Length N/A
Bottom Cap (Y/N) Y N/A

BACKFILL PLUG
Material N/A
Steup /Hydration Time N/A
Tremied (Y /N) N

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 8/30/90

Client/Project: MMES / Savannah

Site No. No. 7

Installation: Georgia Air National Guard

Well No. 07-MW-01

HAZWRAP Contractor: CH2M HILL

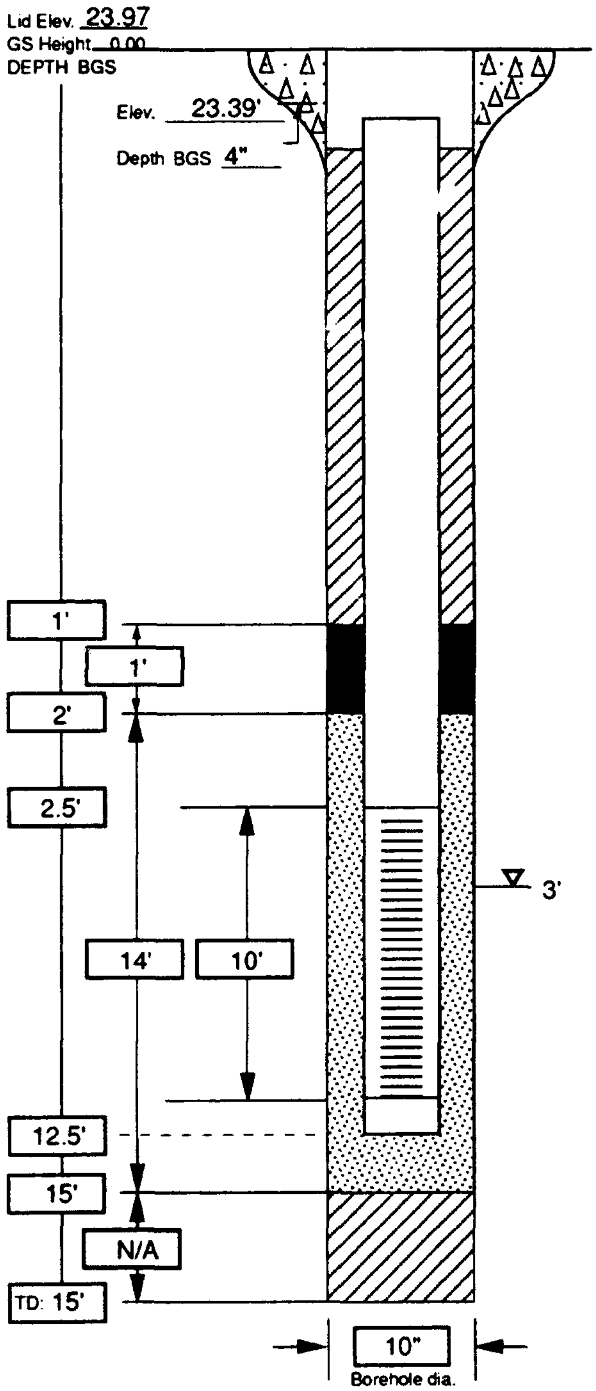
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 9:20 am

Drilling Contractor: E.E.I. /Turner

Comp. End: 10:15 am



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N) Y

Depth BGS 5" Weep hole (Y/N) Y

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 0 -2.5'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) N

Interval 0 - 1'

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 12 days Vol. Fluid Added 5 gal.

Tremied (Y /N) N

FILTER PACK

Type Silica Sand

Amt Used 5 - 100 pound bags

Tremied (Y/N) N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 2.5' - 12.5 '

SUMP (Y /N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N) N

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/10/90

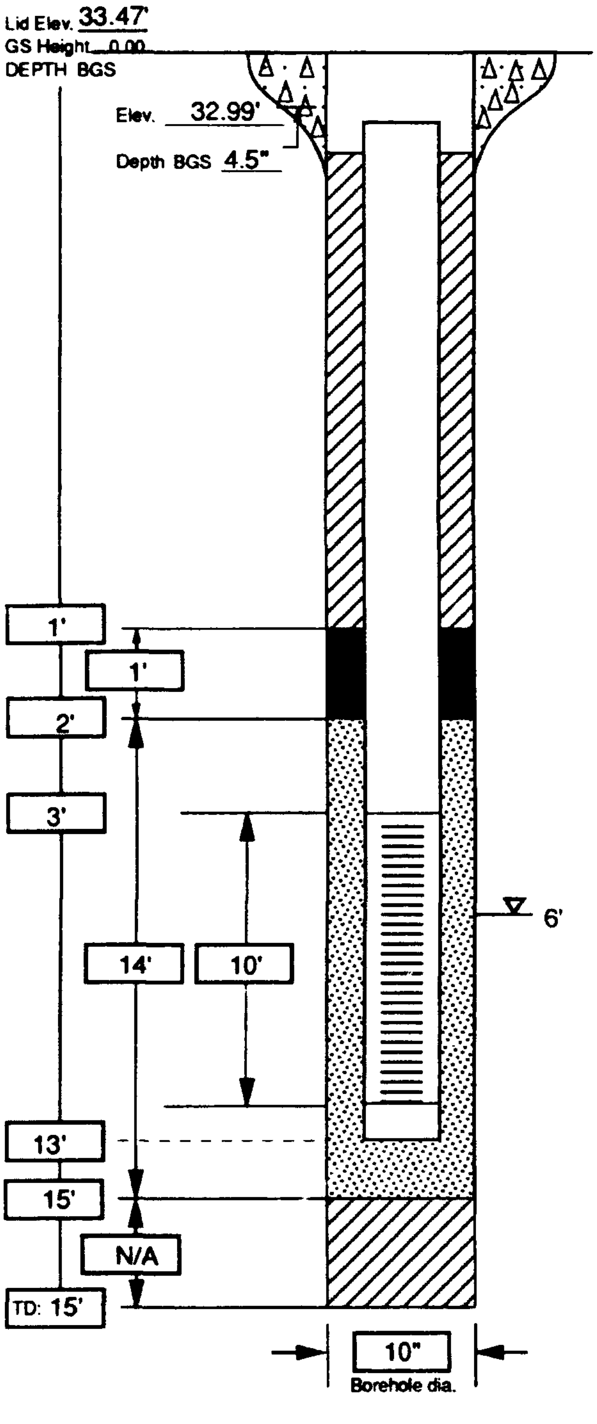
Client/Project: MMES / Savannah
Site No. No. 8

Installation: Georgia Air National Guard
Well No. 08-MW-01

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0

Built by: R. Olson
Comp Start: 6:20 pm

Drilling Contractor: E.E.I. /Turner
Comp. End: 7:10 pm



PROTECTIVE CSG

Material/Type: Steel Flush Mount (Installed 9/12/90)

Diameter: 10" Water Tight Seal (Y/N)

Depth BGS: 6" Weep hole (Y/N)

SURFACE PAD

Composition & Size: 3' x 3' x 6" Concrete

RISER PIPE

Type: PVC Theaded Schedule - 40

Diameter: 2" Diameter

Total Length (TOC to TOS): 3'

GROUT

Composition & Proportions: 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval: 0 - 1'

CENTRALIZERS (Y/N)

Depth (s): N/A

SEAL

Type: Granular Bentonite

Source: N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time: 36 hrs Vol. Fluid Added: 10 gal.

Tremied (Y/N)

FILTER PACK

Type: Silica Sand

Amt Used: 6.5 - 100 pound bags

Tremied (Y/N)

Source: Foster Dixiana

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Theaded Schedule - 40

Diameter: 2 inch diameter

Slot Size & Type: No. 10 (0.010 inch) Factory Slot

Interval BGS: 3' - 13'

SUMP (Y/N)

Interval BGS: N/A Length: N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material: N/A

Steup /Hydration Time: N/A

Tremied (Y/N)

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 9/8/90

Client/Project: MMES / Savannah

Site No. No. 8

Installation: Georgia Air National Guard

Well No. 08-MW-02

HAZWRAP Contractor: CH2M HILL

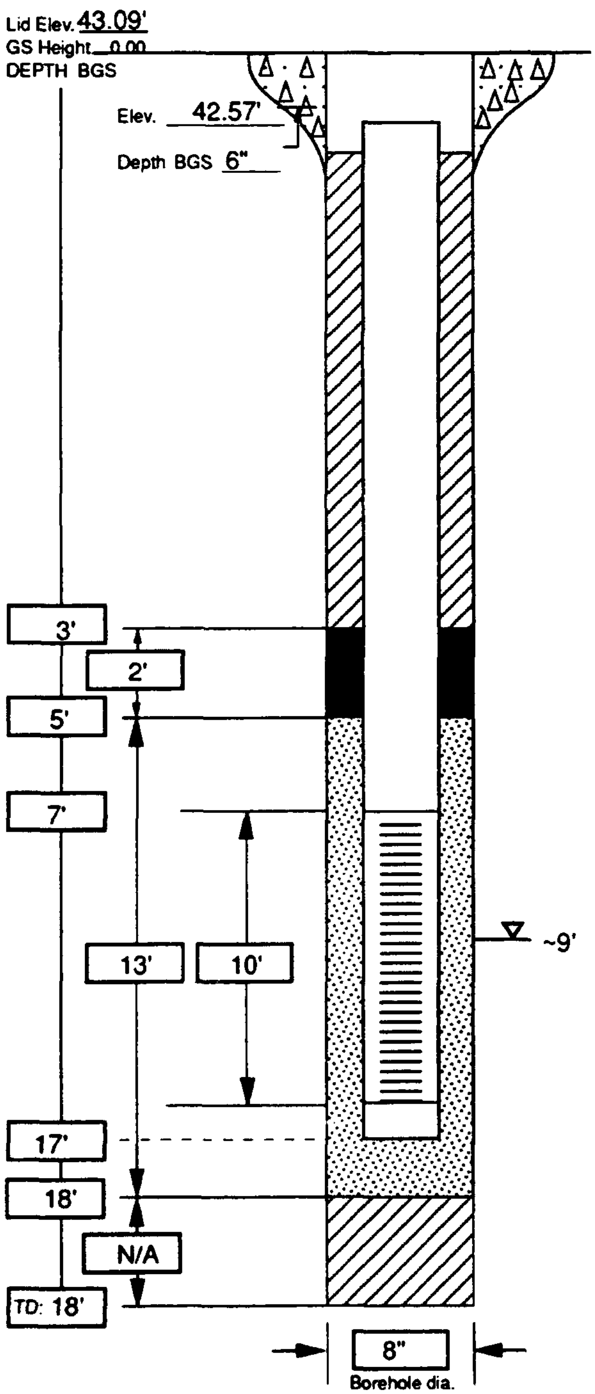
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 6:22 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 8:10 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installled 9/9/90)

Diameter 10" Water Tight Seal (Y/N) Y

Depth BGS 6.5" Weep hole (Y/N) Y

SURFACE PAD

Composition & Size In Apron - No Pad

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 7'

GROUT

Composition & Proportions 1 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) N

Interval 0 - 3'

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 14 hrs Vol. Fluid Added 10 gal.

Tremied (Y /N) N

FILTER PACK

Type Silica Sand

Amt Used 3.5 - 100 pound bags

Tremied (Y/N) N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 7' - 17 '

SUMP (Y /N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N) N

CH2M HILL

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/8/90

Client/Project: MMES / Savannah

Site No. No. 8

Installation: Georgia Air National Guard

Well No. 08-MW-03

HAZWRAP Contractor: CH2M HILL

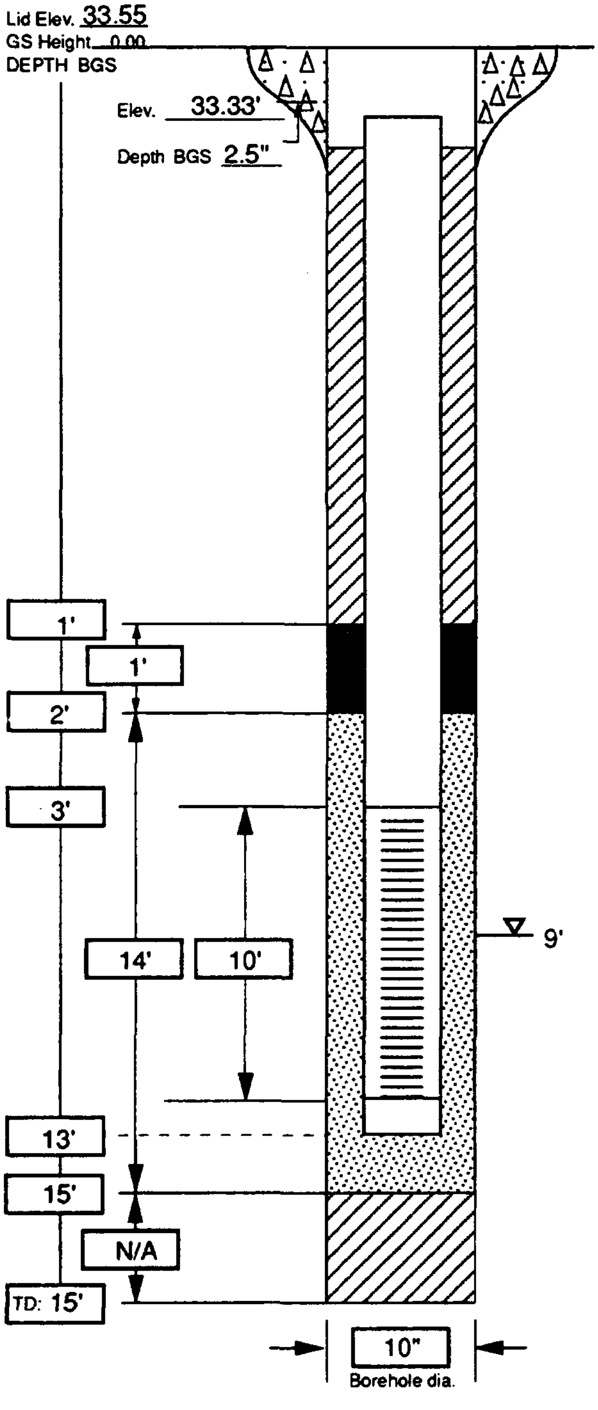
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 9:05 am

Drilling Contractor: E.E.I. /Turner

Comp. End: 10:00 am



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 4" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 1'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 4 days Vol. Fluid Added 20 gal.

Tremied (Y/N)

FILTER PACK

Type Silica Sand

Amt Used 7 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 3' - 13'

SUMP (Y/N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N)

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/8/90

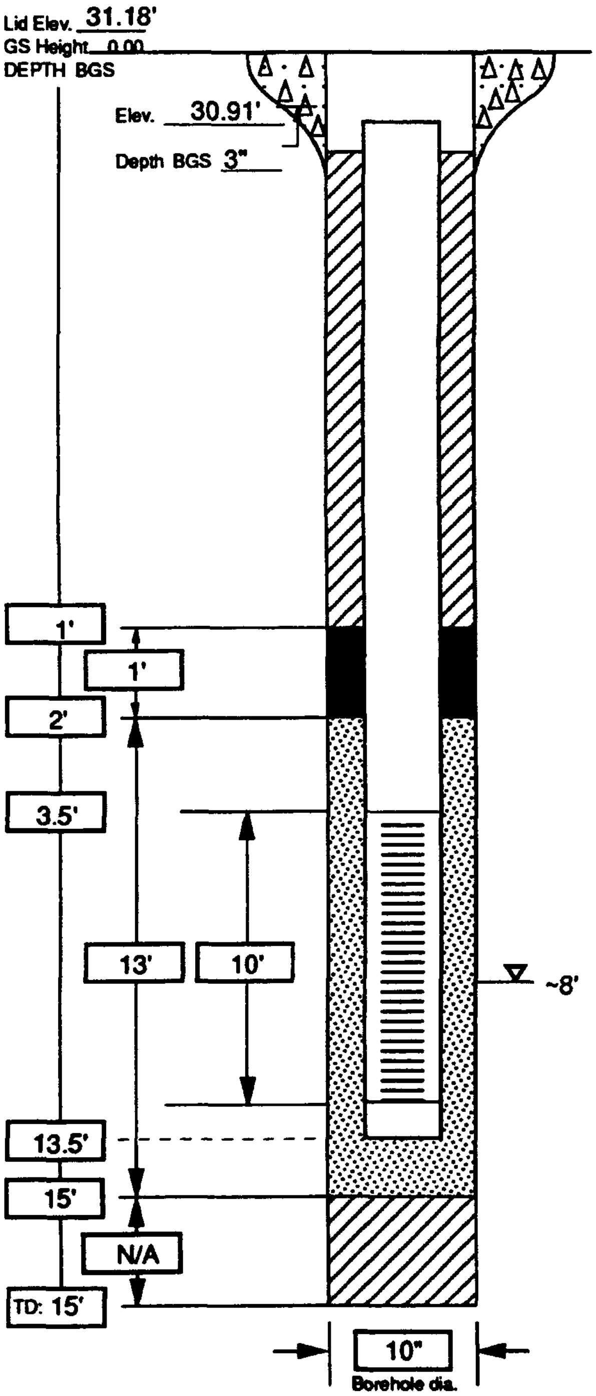
Client/Project: MMES / Savannah
Site No. No. 8

Installation: Georgia Air National Guard
Well No. 08-MW-04

HAZWRAP Contractor: CH2M HILL
Project No. SEF27794.C0

Built by: R. Olson
Comp Start: 11:42 am

Drilling Contractor: E.E.I. /Turner
Comp. End: 1:30 pm



PROTECTIVE CSG

Material/Type: Steel Flush Mount (Installed 9/12/90)

Diameter: 10" Water Tight Seal (Y/N)

Depth BGS: 4" Weep hole (Y/N)

SURFACE PAD

Composition & Size: 3' x 3' x 6' Concrete

RISER PIPE

Type: PVC Theaded Schedule - 40

Diameter: 2" Diameter

Total Length (TOC to TOS): 3.5'

GROUT

Composition & Proportions: 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval: 0 - 1'

CENTRALIZERS (Y/N)

Depth (s): N/A

SEAL

Type: Granular Bentonite

Source: N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time: 4 days Vol. Fluid Added: 20 gal.

Tremied (Y/N)

FILTER PACK

Type: Silica Sand

Amt Used: 6 - 100 pound bags

Tremied (Y/N)

Source: Foster Dixiana

Gr. Size Dist.: 20/40

SCREEN

Type: PVC Theaded Schedule - 40

Diameter: 2 inch diameter

Slot Size & Type: No. 10 (0.010 inch) Factory Slot

Interval BGS: 3.5' - 13.5'

SUMP (Y/N)

Interval BGS: N/A Length: N/A

Bottom Cap (Y/N): N/A

BACKFILL PLUG

Material: N/A

Setup /Hydration Time: N/A

Tremied (Y/N)

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 9/4/90

Client/Project: MMES / Savannah

Site No. No. 9

Installation: Georgia Air National Guard

Well No. 09-MW-01

HAZWRAP Contractor: CH2M HILL

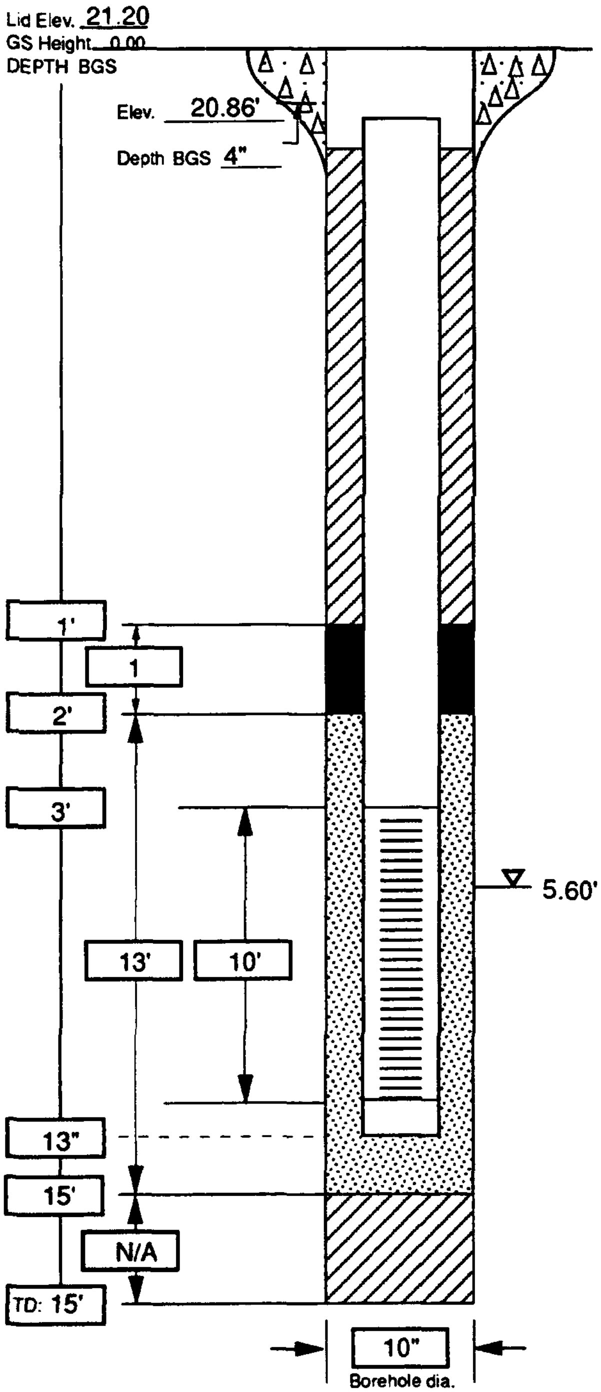
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 5:00 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 5:40 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/90)

Diameter 10" Water Tight Seal (Y N)

Depth BGS 5" Weep hole (Y N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 0 - 3'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y N)

Interval 0 - 1'

CENTRALIZERS (Y N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 8 bags Vol. Fluid Added 10 gal.

Tremied (Y / N)

FILTER PACK

Type Silica Sand

Amt Used 7 - 100 pound bags

Tremied (Y N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 3' - 13 '

SUMP (Y / N)

Interval BGS N/A Length N/A

Bottom Cap (Y N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y / N)

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/5/90

Client/Project: MMES / Savannah

Site No. No. 9

Installation: Georgia Air National Guard

Well No. 09-MW-02

HAZWRAP Contractor: CH2M HILL

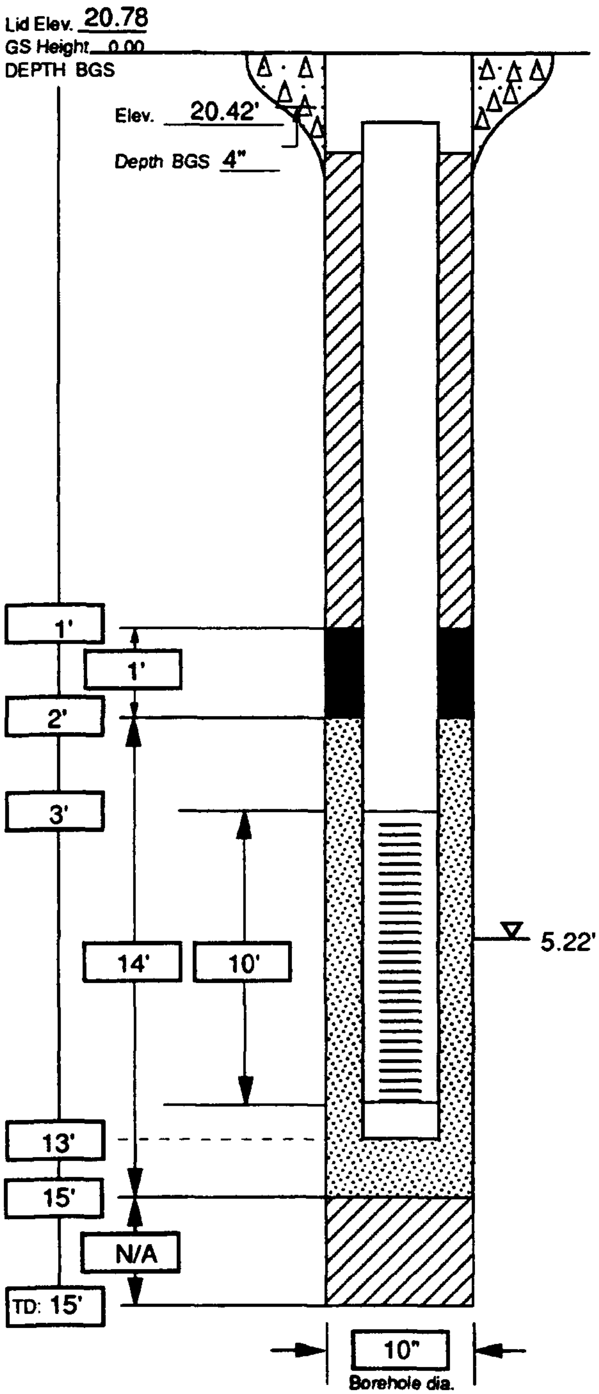
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 3:35 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 4:18 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/20)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 5" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval N/A

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 7 days Vol. Fluid Added 10 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 5.5 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 Slot (0.010 inch) Factory Slot

Interval BGS 3' - 13'

SUMP (Y /N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/5/90

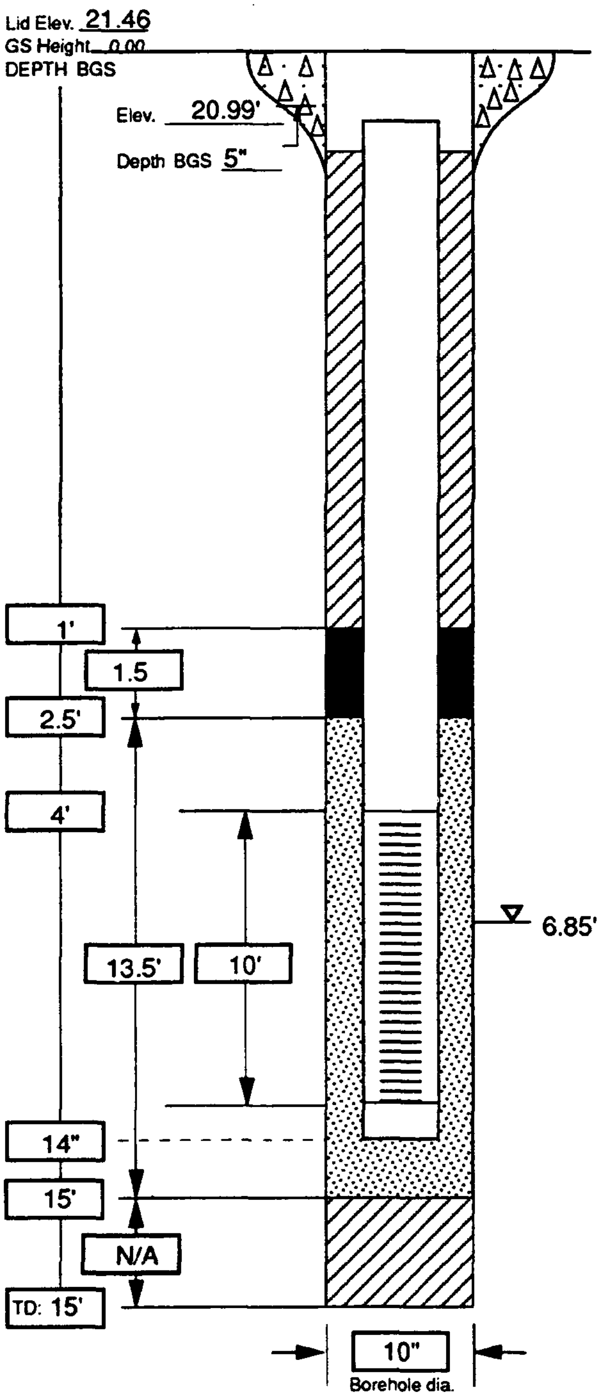
Client/Project: MMES / Savannah — Site No. No. 9

Installation: Georgia Air National Guard — Well No. 09-MW-03

HAZWRAP Contractor: CH2M HILL — Project No. SEF27794.C0

Built by: R. Olson — Comp Start: 9:51 am

Drilling Contractor: E.E.I. /Turner — Comp. End: 10:35 am



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/90)

Diameter 10" — Water Tight Seal (Y/N)

Depth BGS 6" — Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 4'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval N/A

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 7 days — Vol. Fluid [illegible]ed 10 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 5.5 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 4' - 14 '

SUMP (Y /N)

Interval BGS N/A — Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/4/90

Client/Project: MMES / Savannah

Site No. No. 9

Installation: Georgia Air National Guard

Well No. 09-MW-04

HAZWRAP Contractor: CH2M HILL

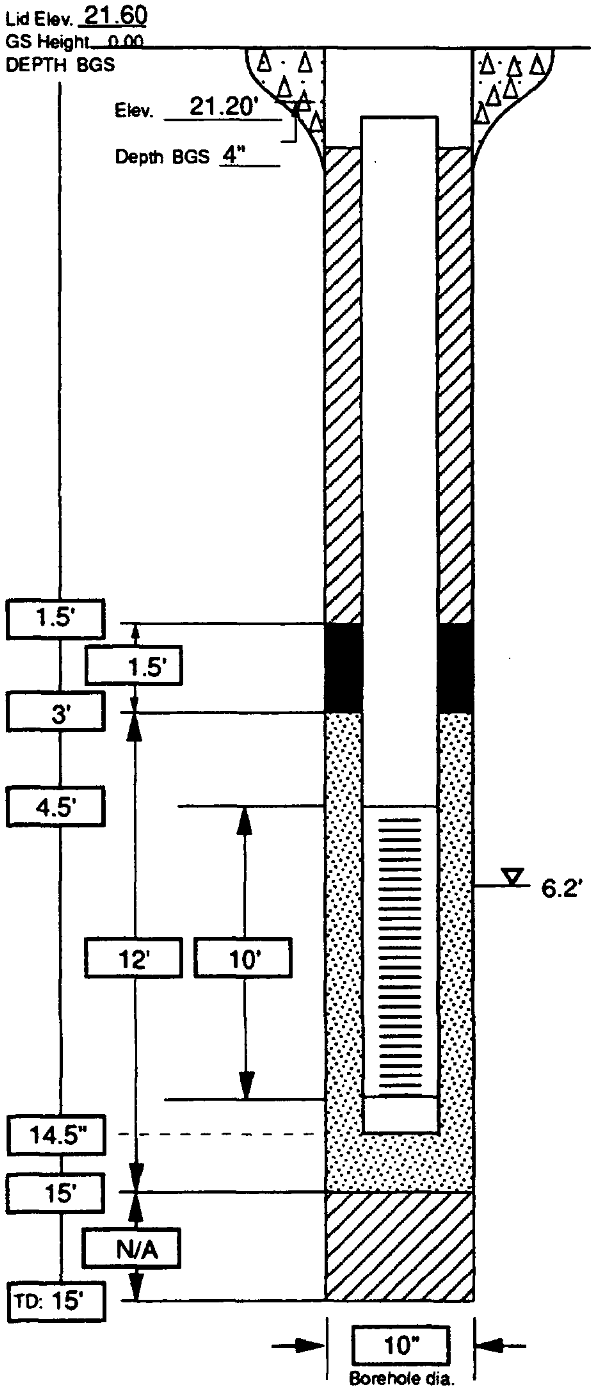
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 2:15 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 3:00 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 5" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 4.5'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 1.5'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 8 days Vol. Fluid Added 10 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 5 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 4.5' - 14.5 '

SUMP (Y /N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

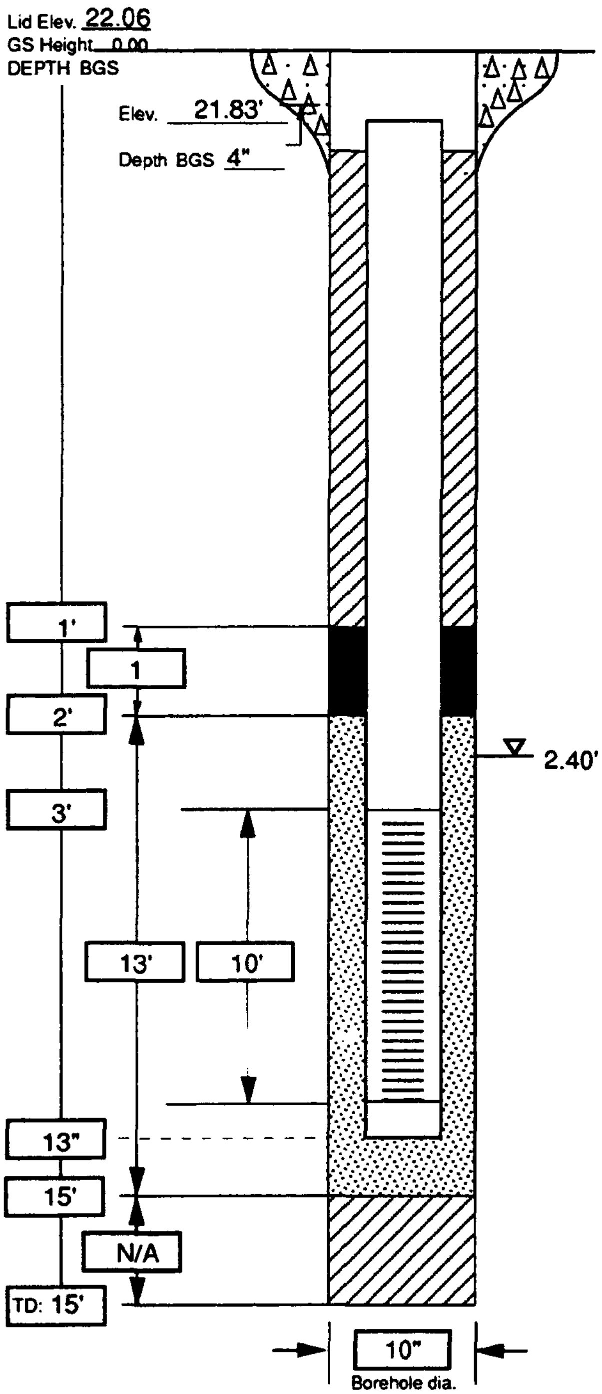
Tremied (Y /N)

MONITORING WELL CONSTRUCTION LOG STANDARD

Date: 9/5/90

Client/Project: MMES / Savannah
Installation: Georgia Air National Guard
HAZWRAP Contractor: CH2M HILL
Built by: R. Olson
Drilling Contractor: E.E.I. /Turner

Site No. No. 9
Well No. 09-MW-05 / Background
Project No. SEF27794.C0
Comp Start: 12:15 pm
Comp. End: 1:06 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/12/90)
Diameter 10" Water Tight Seal (Y/N)
Depth BGS 5" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40
Diameter 2" Diameter
Total Length (TOC to TOS) 3'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag
Tremied (Y/N)
Interval 0 - 1'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite
Source N.L. Petroleum Services, Inc. - Hole Plug
Setup /Hydration Time 7 days Vol. Fluid Added 10 gal.
Tremied (Y/N)

FILTER PACK

Type Silica Sand
Amt Used 5 - 100 pound bags
Tremied (Y/N)
Source Foster Dixiana
Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40
Diameter 2 inch diameter
Slot Size & Type No.10 (0.010 inch) Factory Slot
Interval BGS 3' - 13'

SUMP (Y/N)

Interval BGS N/A Length N/A
Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A
Steup /Hydration Time N/A
Tremied (Y/N)

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 9/10/90

Client/Project: MMES / Savannah

Site No. No. 10

Installation: Georgia Air National Guard

Well No. 10-MW-01

HAZWRAP Contractor: CH2M HILL

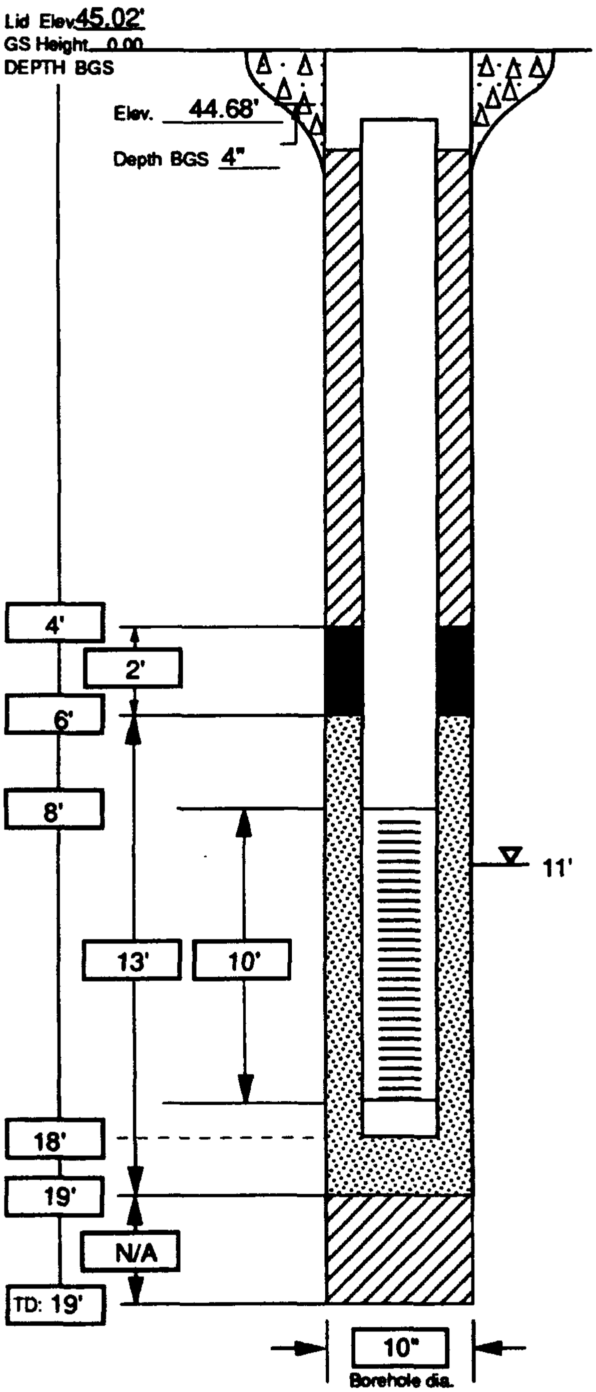
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 2:53 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 4:23 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/10/90)

Diameter 10" Water Tight Seal (Y/N) Y

Depth BGS 4.5" Weep hole (Y/N) Y

SURFACE PAD

Composition & Size 3' x 3' x 6" Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 8'

GROUT

Composition & Proportions 4 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) N

Interval 0 - 4'

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 30 min. Vol. Fluid Added 20 gal.

Tremied (Y /N) N

FILTER PACK

Type Silica Sand

Amt Used 6 - 100 pound bags

Tremied (Y/N) N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 8' - 18'

SUMP (Y /N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N) N

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/6/90

Client/Project: MMES / Savannah

Site No. No. 11

Installation: Georgia Air National Guard

Well No. 11-MW-01

HAZWRAP Contractor: CH2M HILL

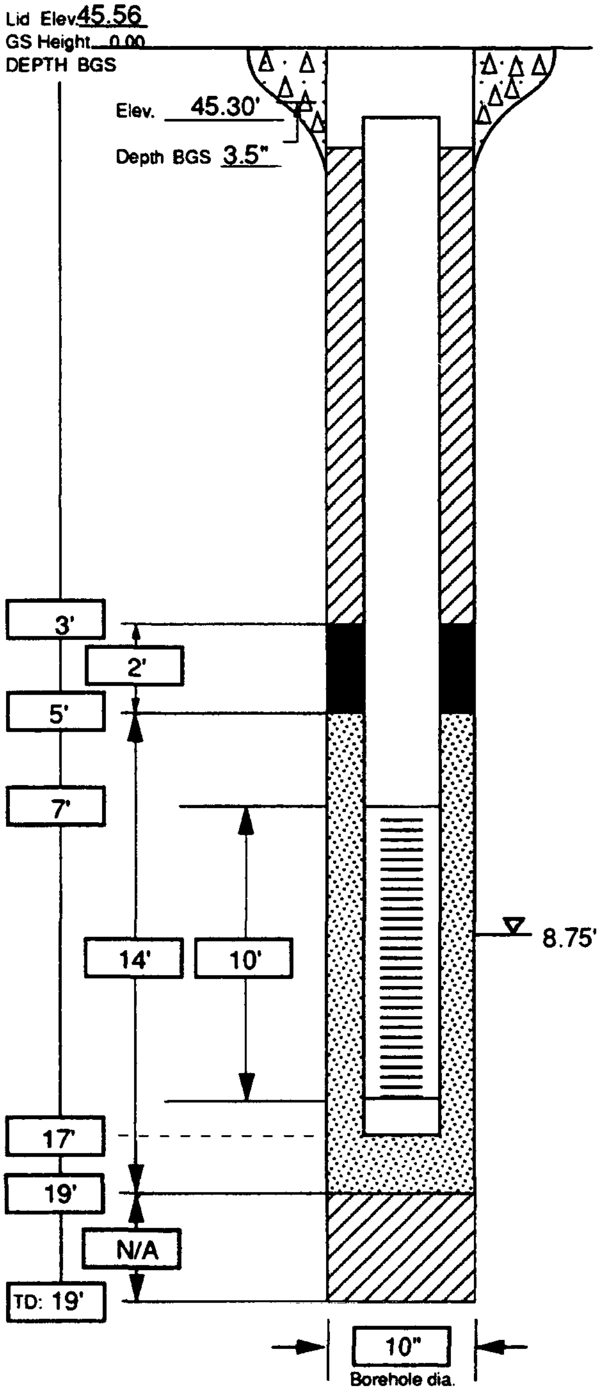
Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 12:53 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 1:50 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N) — Y circled

Depth BGS 4.5" Weep hole (Y/N) — Y circled

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 7'

GROUT

Composition & Proportions 8 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) — N circled

Interval 0 - 3'

CENTRALIZERS (Y/N) — N circled

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 5 days Vol. Fluid Added 10 gal.

Tremied (Y/N) — N circled

FILTER PACK

Type Silica Sand

Amt Used 5.5 - 100 pound bags

Tremied (Y/N) — N circled

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 7' - 17'

SUMP (Y/N) — N circled

Interval BGS N/A Length N/A

Bottom Cap (Y/N) — Y circled N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N) — N circled

MONITORING WELL CONSTRUCTION LOG
STANDARD

Date: 9/6/90

Client/Project: MMES / Savannah

Site No. No. 11

Installation: Georgia Air National Guard

Well No. 11-MW-02

HAZWRAP Contractor: CH2M HILL

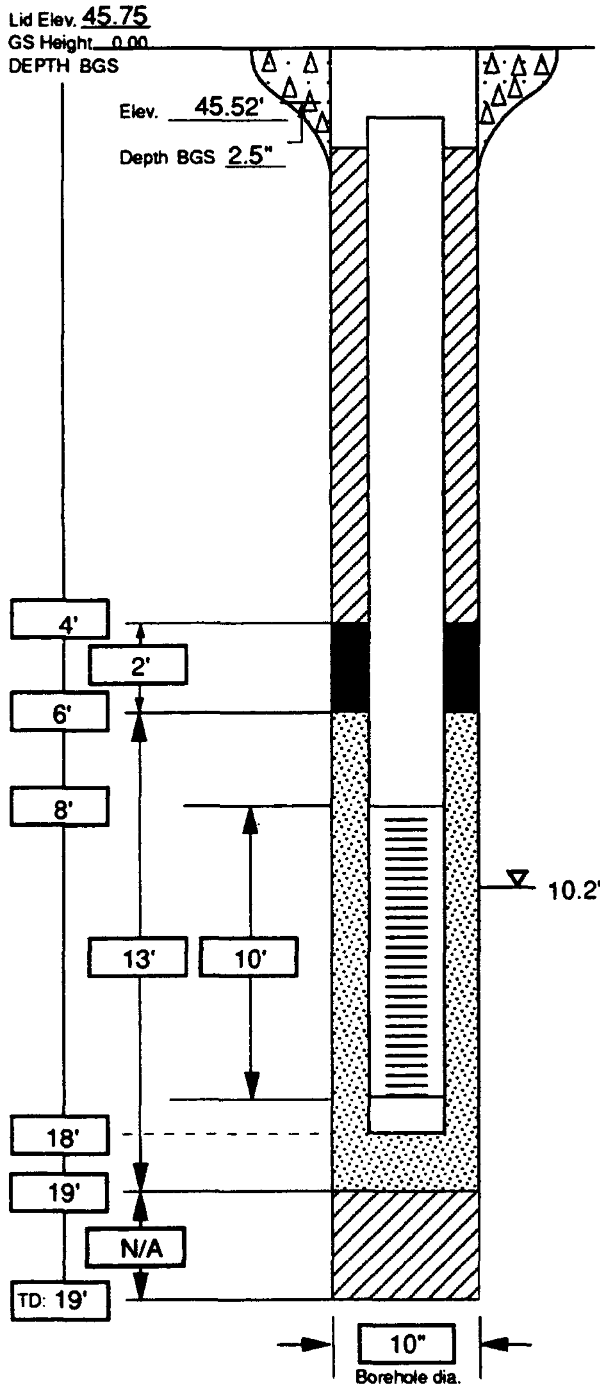
Project No. SEF27794.C0

Built by: R. Olson

Comp Start 5:16 pm

Drilling Contractor: E.E.I. /Turner

Comp. End: 6:00 pm



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N) Y

Depth BGS 4.5" Weep hole (Y/N) Y

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 8'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N) N

Interval 0 - 4'

CENTRALIZERS (Y/N) N

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 5 days Vol. Fluid Added 20 gal.

Tremied (Y/N) N

FILTER PACK

Type Silica Sand

Amt Used 6 - 100 pound bags

Tremied (Y/N) N

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 8' - 18 '

SUMP (Y/N) N

Interval BGS N/A Length N/A

Bottom Cap (Y/N) Y N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y/N) N

MONITORING WELL CONSTRUCTION LOG STANDARD

CH2M HILL

Date: 9/7/90

Client/Project: MMES / S avannah

Site No. No. 11

Installation: Georgia Air National Guard

Well No. 11-MW-03

HAZWRAP Contractor: CH2M HILL

Project No. SEF27794.C0

Built by: R. Olson

Comp Start: 4:47 pm

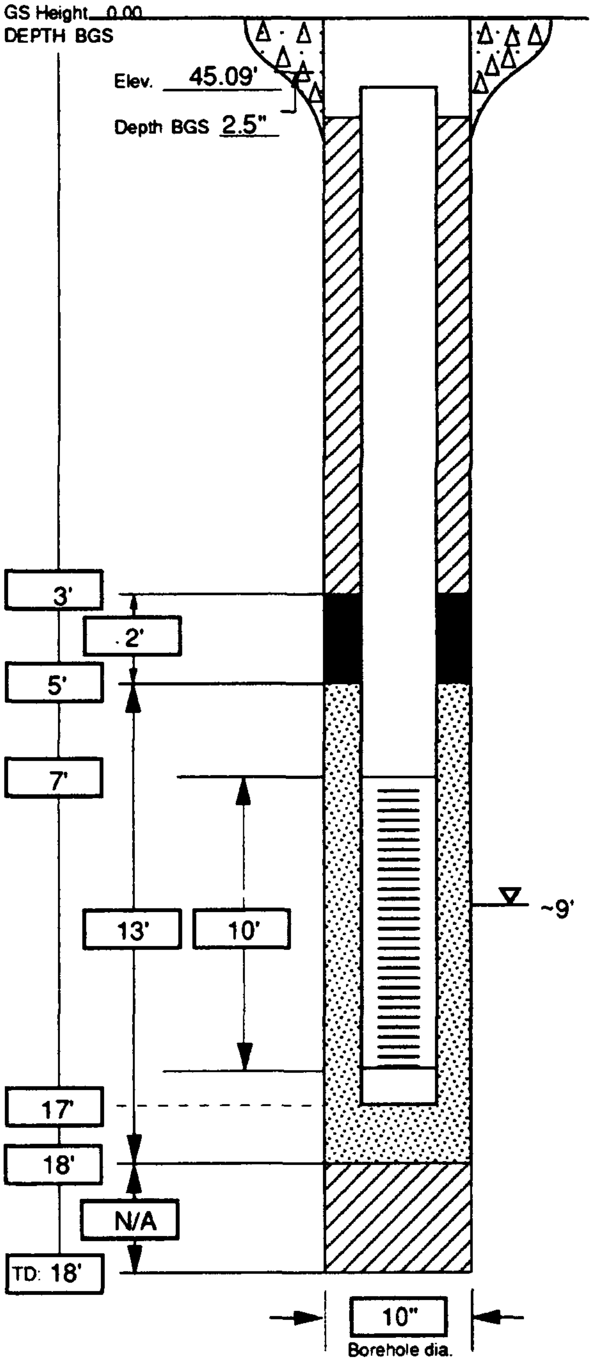
Drilling Contractor: E.E.I. /Turner

Comp. End: 5:27 pm

Lid Elev. 45.38

GS Height 0.00

DEPTH BGS



PROTECTIVE CSG

Material/Type Steel Flush Mount (Installed 9/11/90)

Diameter 10" Water Tight Seal (Y/N)

Depth BGS 4" Weep hole (Y/N)

SURFACE PAD

Composition & Size 3' x 3' x 6' Concrete

RISER PIPE

Type PVC Theaded Schedule - 40

Diameter 2" Diameter

Total Length (TOC to TOS) 7'

GROUT

Composition & Proportions 9 (80#) bags Quickrete with 0.75 gallons of water per bag

Tremied (Y/N)

Interval 0 - 3'

CENTRALIZERS (Y/N)

Depth (s) N/A

SEAL

Type Granular Bentonite

Source N.L. Petroleum Services, Inc. - Hole Plug

Setup /Hydration Time 4 days Vol. Fluid Added 20 gal.

Tremied (Y /N)

FILTER PACK

Type Silica Sand

Amt Used 6 - 100 pound bags

Tremied (Y/N)

Source Foster Dixiana

Gr. Size Dist. 20/40

SCREEN

Type PVC Theaded Schedule - 40

Diameter 2 inch diameter

Slot Size & Type No. 10 (0.010 inch) Factory Slot

Interval BGS 7' - 17'

SUMP (Y /N)

Interval BGS N/A Length N/A

Bottom Cap (Y/N) N/A

BACKFILL PLUG

Material N/A

Steup /Hydration Time N/A

Tremied (Y /N)

Engineers
Planners
Economists
Scientists

February 11, 1991

SEF27794.C0

Captain Salvador Sanchez
Assistant Base Civil Engineer
165th Tactical Airlift Group
Georgia Air National Guard
P.O. Box 7568
Garden City. GA 31498-7568

Dear Sal:

Subject: Drilling Derived Wastes Generated During Site Investigation Field Activities

During the installation of the permanent monitoring wells at the Georgia Air National Guard Base in Savannah, Georgia, soil cuttings produced during well construction were screened in the field using an HNu photoionization detector. The results of this activity indicated that some of the soils possessed traces of volatile organic compounds.

As specified in our Sampling and Analysis Plan (SAP), soils that screened positive were placed into drums and transported to the driller's staging area at Building 510. Fourteen drums (from 10 well locations) were moved and stored in the parking lot on the northeast side of Building 510. The drums were painted with the well number and the date that they were generated.

On September 22, 1990, composite samples were collected from drums generated from each location. The samples were analyzed for hazard characteristics following the Toxicity Characteristics Leaching Procedure (TCLP) guidelines. The parameters analyzed included volatile and semi-volatile compounds, pesticides, herbicides, select metals, ignitability, sulfides, and pH. The analysis for these parameters was performed in CH2M HILL's laboratory in Gainesville, Florida and reported on November 9, 1990.

The results of the analysis indicated that most of the soils did not contain target constituents or possess hazardous characteristics. However, several metals were detected in each of the drums including chromium, lead, and barium. Although these metals were detected at concentrations above laboratory method detection limits, their respective concentrations were substantially below the EPA action levels. Therefore, metals contamination is apparently not a concern in the drumr··:d soil.

Soil from two of the drums (generated from 08-MW-01 and the decon area) contained trichloroethene (TCE) at slightly elevated levels. TCE is a solvent that was detected at several locations around Site No. 8 (Old 165th Aircraft Washrack). In

addition, decontamination wastes (washed off of the drilling equipment and collected at the driller's staging area) also contained TCE. Drilling equipment was decontaminated on plastic sheeting at Building 510. Following the driller's demobilization all soils remaining on the sheeting were drummed as potentially contaminated wastes. Since Monitor Well 08-MW-01 was the final well installed, it appears that this well was the source of the contaminant. The groundwater sample collected from this well would appear to confirm this suspicion.

According to 40 CFR, Section 261.30, the drummed soils are the result of contamination by an F001 hazardous waste. Although the soil contains TCE at detectable levels (8 micrograms per liter [μg/l], the TCE concentration is below the action level of 500 μg/l as defined by EPA. Additionally, the soils do not demonstrate hazardous characteristics as defined in 40 CFR, Section 261.3. Therefore, the soils generated as part of the site investigation may be disposed as a nonhazardous waste. A copy of the analytical results is included following this letter for your review. A summary of the results is presented in Table 1.

Some portions of the drums could contain some residual volatile organics. To prevent returning these volatile organics to the subsurface, the drummed soils should be allowed to aerate or "land farmed". Land farming should be performed following a fairly simple procedure. Soils should be dumped from the drums and spread on plastic sheeting on-top-of an impermeable or paved surface. This could easily be accomplished at Building 510. The soils should be spread in a layer approximately 6-inches thick to expose the soil to air. At about every 72 hours, the soil should be mixed using a rake to aerate any remaining volatile compounds. Between periods when the soils are tilled, they should be covered with plastic to prevent rainwater contact. This process should take approximately 1 week to complete. After this period, the soil can be spread at a location of your choice.

If you have any questions about the analytical results or possib'e methods which could be used to land farm the soil, please contact Rick Olson or me for assistance.

Sincerely,

CH2M HILL

Mark S. Morris

Mark S. Morris, Ph.D., P.E.
Project Manager

dbt104/005.51
Enclosures
cc: Del Long/Martin Marietta Energy Systems, Inc.
Rick Olson/CH2M HILL

Table 1
Georgia Air National Guard
Drilling Derived Wastes

Sample Location	Volatiles Compounds	Semivolatiles Compounds	TCLP Pesticides	TCLP Herbicides	TCLP Metals	TCLP Metals Regulatory Levels	Ignitability	pH	Sulfides
05-DC-01	BMDL	BMDL	BMDL	BMDL	1,000 µg/l Barium	100,000 µg/l	Non-Ignit.	5.4	BMDL
05-DC-02	BMDL	BMDL	BMDL	BMDL	590 µg/l Barium	100,000 µg/l	Non-Ignit.	5.1	BMDL
					200 µg/l Lead	5,000 µg/l			
05-DC-03	BMDL	BMDL	BMDL	BMDL	370 µg/l Barium	100,000 µg/l	Non-Ignit.	5.0	BMDL
05-DC-04	BMDL	BMDL	BMDL	BMDL	610 µg/l Barium	100,000 µg/l	Non-Ignit.	5.5	BMDL
07-DC-01	BMDL	BMDL	BMDL	BMDL	950 µg/l Barium	100,000 µg/l	Non-Ignit.	5.9	BMDL
					57 µg/l Chromium	5,000 µg/l			
08-DC-01	8 µg/l TCE	BMDL	BMDL	BMDL	620 µg/l Barium	100,000 µg/l	Non-Ignit.	5.2	BMDL
09-DC-02	BMDL	BMDL	BMDL	BMDL	460 µg/l Barium	100,000 µg/l	Non-Ignit.	5.8	BMDL
10-DC-01	BMDL	BMDL	BMDL	BMDL	410 µg/l Barium	100,000 µg/l	Non-Ignit.	5.2	BMDL
11-DC-01	BMDL	BMDL	BMDL	BMDL	640 µg/l Barium	100,000 µg/l	Non-Ignit.	6.2	BMDL
					220 µg/l Lead	5,000 µg/l			
11-DC-02	BMDL	BMDL	BMDL	BMDL	240 µg/l Barium	100,000 µg/l	Non-Ignit.	5.4	BMDL
DECON	8 µg/l TCE	BMDL	BMDL	BMDL	560 µg/l Barium	100,000 µg/l	Non-Ignit.	5.7	BMDL

Note: BMDL = Below method detection limits
DC = Drill cuttings
µg/l = Micrograms per liter (equivalent to parts per billion)
TCE = Trichloroethene

CH2M HILL
Engineers
Planners
Economists
Scientists

November 1, 1990

SEF27794.C0.02

Mr. Don Hash
CH2M HILL/LGN
7201 N.W. 11th Place
Gainesville, FL 32605

RE: Analytical Data for Georgia Air National Guard, Laboratory No. 16874

Dear Mr. Hash:

On September 25, 1990, the CH2M Hill Montgomery Laboratory received eleven samples with a request for analysis of selected organic and inorganic parameters.

The analytical results and associated quality control data are enclosed. The semivolatile, pesticide, and herbicide TCLP extractions were performed on 10/04/90. The semivolatile analysis for sample 16874003 showed three base/neutral surrogates below normal QC limits. There was not enough sample to re-extract; therefore, the laboratory took no further action.

Herbicide surrogate recoveries for all TCLP sample are low. Spiking studies to investigate these low recoveries indicate that a large concentration of acetic acid present in all TCLP leachates has consumed the diazomethane derivatizing reagent in concert and in competition with the surrogate and target compounds. Our corrective action for your samples has been to raise TCLP reporting limits ten fold to reflect and compensate for the low recoveries for these samples. Although the reporting limits have been increased, they are still well below regulatory limits. We regret that this problem was not discovered before expiration of holding times for your samples.

The sulfide was analyzed as "extractable sulfide" (see Redding laboratory report). This procedure would tend to yield lower values than the "total sulfide" method performed previously. Historical data on this job reflects low total sulfide concentrations (well below the 500 PPM action level). No other difficulties were encountered during the analysis of these samples.

The Sulfide analysis was performed at our Redding, California laboratory. A copy of their report is enclosed.

If you should have any questions concerning the data, please inquire.

Sincerely,

Wanda L. Hall
for Craig Vinson
Laboratory Manager

Enclosures

cc: Ms. Mary Wisdom/LMG

Engineers
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TABLE OF CONTENTS

CH2M HILL Laboratory No. 16874

CH2M HILL Montgomery Environmental Laboratory 2567 Fairlane Drive, P.O. Box 230548, Montgomery, Alabama 36116 205.271.1444

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TABLE OF CONTENTS (cont.)

CH2M HILL Laboratory No. 16874

CH2M HILL Montgomery Environmental Laboratory 2567 Fairlane Drive, P.O. Box 230548, Montgomery, Alabama 36116 205.271.1444

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TABLE OF CONTENTS (cont.)

CH2M HILL Laboratory No. 16874

CH2M HILL Montgomery Environmental Laboratory 2567 Fairlane Drive. P.O. Box 230548, Montgomery, Alabama 36116 205.271.1444

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ANALYTICAL METHODOLOGY

Organic Analysis

Priority Pollutants: Water, soil and waste samples are analyzed in accordance with procedures described in Methods 608, 624, and 625, EPA-600/4-82-057 (1982); Methods 8080, 8240, and 8270, Test Methods for Evaluating Solid Waste, 1986, SW-846, Third Edition; and methods outlined in the USEPA Contract Laboratory Program Statement of Work for Organics Analysis, February, 1988.

Volatile Analysis (Safe Drinking Water Act): Water samples are analyzed in accordance with procedures described in Method 524.2, Federal Register (50 FR 46902), November 13, 1985.

Chlorinated Phenoxyacid Herbicides: Samples are analyzed with procedures described in Method 8150, Test Methods for Evaluating Solid Waste, 1986, SW-846, Third Edition.

Organophosphate Pesticides: Samples are analyzed in accordance with procedures described in Methods 614 and 622, EPA-600/4-79-019 (1979) and in Method 8140, Test Methods for Evaluating Solid Waste, 1986, SW-846, Third Edition.

Phenol Analysis by GC: Samples are analyzed in accordance with procedures outlined in Method 604, Federal Register, 40 CFR, Part 136 (July 1, 1987) and in Method 8040, Test Methods for Evaluating Solid Waste, 1986, SW-846, Third Edition.

Polynuclear Aromatic Hydrocarbons (GC analysis): Samples are analyzed with procedures described in Method 610, Federal Register, 40 CFR, Part 136 (July 1, 1987) and in Method 8100, Test Methods for Evaluating Solid Waste, 1986, SW-846, Third Edition.

Ethylene Dibromide : Water samples are analyzed in accordance with procedures outlined in Method 504, Federal Register (50 FR 46902), November 13, 1985.

Trihalomethanes: Water samples are analyzed with procedures described in Method 501.2, Federal Register, Vol. 44, No. 231, Part II, November 29, 1979.

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EPA - DEFINED QUALIFIERS

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Definitions for the EPA-defined qualifiers:

U -- Indicates the compound was analyzed for but not detected. The number adjacent to the "U" qualifier indicates the quantitation limit for that compound. The detection limit can vary from sample to sample depending on dilution factors or percent moisture adjustment when indicated.

J -- Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound below the stated quantitation limit. The "J" qualifier is not used with pesticide results.

C -- This flag applies to pesticide results only. The "C" flag indicates the presence of this compound has been confirmed by GC/MS analysis.

B -- This flag is used when the analyte is found in the associated blank as well as the sample. This notation indicates possible blank contamination and suggests the data user evaluate these compounds and their amounts carefully.

E -- This flag applies to GC/MS only. The "E" qualifier indicates a compound may be above or below the linear range of the instrument. If the particular compound level is deemed above the linear calibration range, then the sample should be reanalyzed at an appropriate dilution. Therefore, the "E" qualified amount is an estimated concentration. The results for the dilution will be reported on a separate Form I and will be flagged with a "D" if the dilution brings the concentration within proper calibration.

D -- This flag identifies compounds which have been run at a dilution to bring the concentration of that compound within the linear range of the instrument. "D" qualifiers are only used for samples that have been run initially with results above acceptable ranges. For secondary dilutions the "DL" suffix is appended to the sample number on the Form I.

A -- Indicates the Tentatively Identified Compound (TIC) is a suspected aldol-condensation product.

X -- Indicates the compound concentration has been manually modified or the EPA qualifier has been manually modified or added.

JX -- The compound was detected and quantitated below the Contract Required Quantitation Limit.

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CLIENT SAMPLE ID QUALIFIERS

LEVEL 1

The qualifiers that GC/MS uses with the client sample ID are defined below:

DL -- Dilution Run

R -- Rerun (may be followed by a digit to indicate multiple reruns)

RD -- Diluted Rerun

RX -- Re-extraction Analysis

MS -- Matrix Spike (may be followed by a digit to indicate multiple matrix spikes within a sample set)

MSD -- Matrix Spike Duplicate (may be followed by a digit to indicate multiple matrix spike duplicates within a sample set)

QC_BLANK -- Method Blank (may be followed by an **S** for soils run at a low level, **W** for waters, or **SM** for soils run at a medium level) (letters may be followed by a digit to indicate multiple blanks of that type; if there are no letters the digit indicates multiple blanks).

These qualifiers allow GC/MS to have unique client sample ID's so that the client can get more accurate information from the data reported.

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TABLE 1

SAMPLE CROSS-REFERENCE SUMMARY

CH2M HILL Laboratory No. 16874

LMG Sample No.	LGN Sample No.	Sample Description			
16874001	85167	SAMPLE 05-DC-01	09/22/90	1535	GRAB
16874002	85168	SAMPLE 05-DC-02	09/22/90	1543	GRAB
16874003	85169	SAMPLE 05-DC-03	09/22/90	1547	GRAB
16874004	85170	SAMPLE 05-DC-04	09/22/90	1552	COMP
16874005	85171	SAMPLE 07-DC-01	09/22/90	1559	GRAB
16874006	85172	SAMPLE 08-DC-01	09/22/90	1604	COMP
16874007	85173	SAMPLE 09-DC-02	09/22/90	1607	GRAB
16874008	85174	SAMPLE 10-DC-01	09/22/90	1617	COMP
16874009	85175	SAMPLE 11-DC-01	09/22/90	1623	GRAB
16874010	85176	SAMPLE 11-DC-02	09/22/90	1628	GRAB
16874011	85177	SAMPLE DECON AREA WASTE	09/22/90	1632	COMP

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/02/90
Lab Sample ID:	16874001	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-01	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	99			
	1,4-Bromofluorobenzene - SS	95			
	1,2-Dichloroethane-d4 - SS	90			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

000001

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/02/90
Lab Sample ID:	16874002	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-02	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	2	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	97			
	1,4-Bromofluorobenzene - SS	95			
	1,2-Dichloroethane-d4 - SS	84			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/02/90
Lab Sample ID:	16874003	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-03	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	5	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	2	J		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	95			
	1,4-Bromofluorobenzene - SS	92			
	1,2-Dichloroethane-d4 - SS	86			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/03/90
Lab Sample ID:	16874004	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-04	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	3	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	98			
	1,4-Bromofluorobenzene - SS	96			
	1,2-Dichloroethane-d4 - SS	78			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/03/90
Lab Sample ID:	16874005	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	07-DC-01	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	3	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	95			
	1,4-Bromofluorobenzene - SS	95			
	1,2-Dichloroethane-d4 - SS	93			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/03/90
Lab Sample ID:	16874006	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	08-DC-01	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	4	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	8			
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	96			
	1,4-Bromofluorobenzene - SS	96			
	1,2-Dichloroethane-d4 - SS	81			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/03/90
Lab Sample ID:	16874007	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	09-DC-02	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	6	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	91			
	1,4-Bromofluorobenzene - SS	97			
	1,2-Dichloroethane-d4 - SS	79			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874008	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	10-DC-01	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	2	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		

	Toluene-d8 - SS	99			
	1,4-Bromofluorobenzene - SS	94			
	1,2-Dichloroethane-d4 - SS	79			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874009	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	11-DC-01	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	4	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	98			
	1,4-Bromofluorobenzene - SS	91			
	1,2-Dichloroethane-d4 - SS	78			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874010	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	11-DC-02	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	97			
	1,4-Bromofluorobenzene - SS	94			
	1,2-Dichloroethane-d4 - SS	79			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874011	Sample Matrix:	SOIL	Date Analyzed:	10/11/90
Client Sample ID:	DECON AREA W	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	8			
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		

	Toluene-d8 - SS	100			
	1,4-Bromofluorobenzene - SS	92			
	1,2-Dichloroethane-d4 - SS	82			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/02/90
Lab Sample ID:	ZH100201	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	BLANK	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	100			
	1,4-Bromofluorobenzene - SS	95			
	1,2-Dichloroethane-d4 - SS	86			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/03/90
Lab Sample ID:	ZH100301	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	BLANK	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	2	J		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		

	Toluene-d8 - SS	95			
	1,4-Bromofluorobenzene - SS	97			
	1,2-Dichloroethane-d4 - SS	83			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	ZH100501	Sample Matrix:	WATER	Date Analyzed:	10/19/90
Client Sample ID:	BLANK	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	96			
	1,4-Bromofluorobenzene - SS	102			
	1,2-Dichloroethane-d4 - SS	86			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	
Lab Sample ID:	K10100B1	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	QC BLANK W	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	100			
	1,4-Bromofluorobenzene - SS	94			
	1,2-Dichloroethane-d4 - SS	91			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

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Jbx

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	
Lab Sample ID:	K10110B1	Sample Matrix:	WATER	Date Analyzed:	10/11/90
Client Sample ID:	QC BLANK W 2	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	1	BJ		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		

	Toluene-d8 - SS	99			
	1,4-Bromofluorobenzene - SS	94			
	1,2-Dichloroethane-d4 - SS	86			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	
Lab Sample ID:	X10190B1	Sample Matrix:	WATER	Date Analyzed:	10/19/90
Client Sample ID:	QC BLANK W 3	Percent Moisture:		Dilution Factor:	1.0

VOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
75-01-4	Vinyl Chloride	10	U		
75-35-4	1,1-Dichloroethene	5	U		
67-66-3	Chloroform	5	U		
107-06-2	1,2-Dichloroethane	5	U		
78-93-3	2-Butanone	10	U		
56-23-5	Carbon Tetrachloride . . .	5	U		
79-01-6	Trichloroethene	5	U		
71-43-2	Benzene	5	U		
127-18-4	Tetrachloroethene	5	U		
108-90-7	Chlorobenzene	5	U		
	Toluene-d8 - SS	94			
	1,4-Bromofluorobenzene - SS	98			
	1,2-Dichloroethane-d4 - SS	84			

U - Compound analyzed for but not detected.
B - Compound was detected in *QC blank*.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874001	Sample Matrix:	SOIL	Date Analyzed:	10/09/90
Client Sample ID:	05-DC-01	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		

	Nitrobenzene-d5 - SS . . .	82			
	2-Fluorobiphenyl - SS . .	88			
	Terphenyl-d14 - SS	73			
	Phenol-d5 - SS	84			
	2-Fluorophenol - SS . . .	94			
	2,4,6-Tribromophenol - SS	59			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874002	Sample Matrix:	SOIL	Date Analyzed:	10/09/90
Client Sample ID:	05-DC-02	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	77			
	2-Fluorobiphenyl - SS . .	78			
	Terphenyl-d14 - SS	68			
	Phenol-d5 - SS	54			
	2-Fluorophenol - SS . . .	75			
	2,4,6-Tribromophenol - SS	62			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874003	Sample Matrix:	SOIL	Date Analyzed:	10/09/90
Client Sample ID:	05-DC-03	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		

	Nitrobenzene-d5 - SS . . .	7			
	2-Fluorobiphenyl - SS . .	7			
	Terphenyl-d14 - SS	15			
	Phenol-d5 - SS	45			
	2-Fluorophenol - SS . . .	56			
	2,4,6-Tribromophenol - SS	30			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874004	Sample Matrix:	SOIL	Date Analyzed:	10/09/90
Client Sample ID:	05-DC-04	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	79			
	2-Fluorobiphenyl - SS . .	83			
	Terphenyl-d14 - SS	70			
	Phenol-d5 - SS	44			
	2-Fluorophenol - SS . . .	50			
	2,4,6-Tribromophenol - SS	54			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874005	Sample Matrix:	SOIL	Date Analyzed:	10/22/90
Client Sample ID:	07-DC-01	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	70			
	2-Fluorobiphenyl - SS . .	68			
	Terphenyl-d14 - SS	68			
	Phenol-d5 - SS	59			
	2-Fluorophenol - SS . . .	53			
	2,4,6-Tribromophenol - SS	56			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874006	Sample Matrix:	SOIL	Date Analyzed:	10/09/90
Client Sample ID:	08-DC-01	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	77			
	2-Fluorobiphenyl - SS . .	82			
	Terphenyl-d14 - SS	70			
	Phenol-d5 - SS	76			
	2-Fluorophenol - SS . . .	82			
	2,4,6-Tribromophenol - SS	54			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874007	Sample Matrix:	SOIL	Date Analyzed:	10/22/90
Client Sample ID:	09-DC-02	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		

	Nitrobenzene-d5 - SS . . .	68			
	2-Fluorobiphenyl - SS . .	62			
	Terphenyl-d14 - SS	65			
	Phenol-d5 - SS	65			
	2-Fluorophenol - SS . . .	61			
	2,4,6-Tribromophenol - SS	61			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874008	Sample Matrix:	SOIL	Date Analyzed:	10/10/90
Client Sample ID:	10-DC-01	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		

	Nitrobenzene-d5 - SS . . .	79			
	2-Fluorobiphenyl - SS . .	79			
	Terphenyl-d14 - SS	65			
	Phenol-d5 - SS	78			
	2-Fluorophenol - SS . . .	66			
	2,4,6-Tribromophenol - SS	62			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874009	Sample Matrix:	SOIL	Date Analyzed:	10/26/90
Client Sample ID:	11-DC-01	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		

	Nitrobenzene-d5 - SS . . .	70			
	2-Fluorobiphenyl - SS . .	70			
	Terphenyl-d14 - SS	76			
	Phenol-d5 - SS	52			
	2-Fluorophenol - SS . . .	66			
	2,4,6-Tribromophenol - SS	50			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874010	Sample Matrix:	SOIL	Date Analyzed:	10/22/90
Client Sample ID:	11-DC-02	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	50	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	64			
	2-Fluorobiphenyl - SS . .	57			
	Terphenyl-d14 - SS	60			
	Phenol-d5 - SS	54			
	2-Fluorophenol - SS . . .	49			
	2,4,6-Tribromophenol - SS	47			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874011	Sample Matrix:	SOIL	Date Analyzed:	10/26/90
Client Sample ID:	DECON AREA W	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	73			
	2-Fluorobiphenyl - SS . .	62			
	Terphenyl-d14 - SS	82			
	Phenol-d5 - SS	38			
	2-Fluorophenol - SS . . .	43			
	2,4,6-Tribromophenol - SS	48			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	TCLP BLANK	Sample Matrix:	SOIL	Date Analyzed:	10/22/90
Client Sample ID:	TC100401	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	79			
	2-Fluorobiphenyl - SS . .	71			
	Terphenyl-d14 - SS	76			
	Phenol-d5 - SS	72			
	2-Fluorophenol - SS . . .	65			
	2,4,6-Tribromophenol - SS	62			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	C10050B1	Sample Matrix:	WATER	Date Analyzed:	10/09/90
Client Sample ID:	QC BLANK W	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	94			
	2-Fluorobiphenyl - SS . .	108			
	Terphenyl-d14 - SS	88			
	Phenol-d5 - SS	93			
	2-Fluorophenol - SS . . .	107			
	2,4,6-Tribromophenol - SS	98			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

000030

psc

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	C10090B1	Sample Matrix:	WATER	Date Analyzed:	10/22/90
Client Sample ID:	QC BLANK W 2	Percent Moisture:		Dilution Factor:	1.0

SEMIVOLATILE TCLP COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
106-46-7	1,4-Dichlorobenzene . . .	10	U		
67-72-1	Hexachloroethane	10	U		
98-95-3	Nitrobenzene	10	U		
87-68-3	Hexachlorobutadiene . . .	10	U		
88-06-2	2,4,6-Trichlorophenol . .	10	U		
95-95-4	2,4,5-Trichlorophenol . .	50	U		
121-14-2	2,4-Dinitrotoluene	10	U		
118-74-1	Hexachlorobenzene	10	U		
87-86-5	Pentachlorophenol	10	U		
110-86-1	Pyridine	50	U		
95-48-7	Cresol (Total)	20	U		
	Nitrobenzene-d5 - SS . . .	68			
	2-Fluorobiphenyl - SS . .	66			
	Terphenyl-d14 - SS	67			
	Phenol-d5 - SS	68			
	2-Fluorophenol - SS . . .	60			
	2,4,6-Tribromophenol - SS	60			

U - Compound analyzed for but not detected.
B - Compound was detected in QC blank.
J - Reported value less than quantitation limit.
SS - Surrogate Standard reported as percent recovery.

Form I

000031

JBx

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874001	Sample Matrix:	WATER	Date Analyzed:	10/11/90
Client Sample ID:	05-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	84			
	Tetrachloro-m-xylene - SS	102			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

Jms

000032

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CH2M HILL

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874002	Sample Matrix:	WATER	Date Analyzed:	10/11/90
Client Sample ID:	05-DC-02	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	64			
	Tetrachloro-m-xylene - SS	81			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

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000033

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CH2M HILL

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874003	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	05-DC-03	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	78			
	Tetrachloro-m-xylene - SS	102			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

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000034

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CH2M HILL

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874004	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	05-DC-04	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	78			
	Tetrachloro-m-xylene - SS	102			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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000035

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CH2M HILL

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874005	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	07-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	77			
	Tetrachloro-m-xylene - SS	100			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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000036

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874006	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	08-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	74			
	Tetrachloro-m-xylene - SS	96			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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000037

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874007	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	09-DC-02	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	68			
	Tetrachloro-m-xylene - SS	94			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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000038

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874008	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	10-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	74			
	Tetrachloro-m-xylene - SS	103			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874009	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	11-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	38			
	Tetrachloro-m-xylene - SS	76			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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000040

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874010	Sample Matrix:	WATER	Date Analyzed:	10/12/90
Client Sample ID:	11-DC-02	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	70			
	Tetrachloro-m-xylene - SS	92			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name: CH2M HILL/MGM Concentration: LOW Date Extracted: 10/08/90
Lab Sample ID: 16874011 Sample Matrix: WATER Date Analyzed: 10/12/90
Client Sample ID: DECON AREA W. Percent Moisture: ______ Dilution Factor: 1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	91			
	Tetrachloro-m-xylene - SS	84			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	TC100401	Sample Matrix:	WATER	Date Analyzed:	10/11/90
Client Sample ID:	TCLP BLANK	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	83			
	Tetrachloro-m-xylene - SS	103			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	C10080B1	Sample Matrix:	WATER	Date Analyzed:	10/11/90
Client Sample ID:	QC BLANK	Percent Moisture:		Dilution Factor:	1.0

TCLP PESTICIDE COMPOUNDS

CAS Number		uq/L		CAS Number	uq/L
58-89-9	gamma-BHC (Lindane) . . .	2	U		
76-44-8	Heptachlor	2	U		
1024-57-3	Heptachlor Epoxide . . .	2	U		
72-20-8	Endrin	2	U		
72-43-5	Methoxychlor	10	U		
57-74-9	Chlordane	10	U		
8001-35-2	Toxaphene	50	U		
	Dibutylchlorendate - SS	64			
	Tetrachloro-m-xylene - SS	106			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

000044

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874001	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	14			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

000045

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name: CH2M HILL/MGM   Concentration: LOW   Date Extracted: 10/05/90
Lab Sample ID: 16874002   Sample Matrix: WATER   Date Analyzed: 10/10/90
Client Sample ID: 05-DC-02   Percent Moisture: ______   Dilution Factor: 1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		

	3,5-Dichlorobenzoic acid - SS	21			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

000046

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874003	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-03	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	23			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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JMB

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874004	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	05-DC-04	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	13			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

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000048

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874005	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	07-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		

	3,5-Dichlorobenzoic acid - SS	09			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

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Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874006	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	08-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	20			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

JMB

000050

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874007	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	09-DC-02	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		uq/L		CAS Number	uq/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	09			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

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000051

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874008	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	10-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	15			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

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000052

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	16874009	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	11-DC-01	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	14			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

000053

CH2M HILL Engineers Planners Economists Scientists

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874010	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	11-DC-02	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		uq/L		CAS Number	uq/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	17			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

JWB

000054

CH2M HILL Engineers Planners Economists Scientists

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/08/90
Lab Sample ID:	16874011	Sample Matrix:	WATER	Date Analyzed:	10/10/90
Client Sample ID:	DECON AREA W.	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	13			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

JWS

000055

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ORGANICS ANALYSIS DATA SHEET

Laboratory Name: CH2M HILL/MGM Concentration: LOW Date Extracted: 10/05/90
Lab Sample ID: TC100401 Sample Matrix: WATER Date Analyzed: 10/10/90
Client Sample ID: TCLP BLANK Percent Moisture: ______ Dilution Factor: 1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	1000	U		
93-72-1	Silvex	100	U		
	3,5-Dichlorobenzoic acid - SS	11			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

JMS

000056

CH2M HILL Engineers Planners Economists Scientists

ORGANICS ANALYSIS DATA SHEET

Laboratory Name:	CH2M HILL/MGM	Concentration:	LOW	Date Extracted:	10/05/90
Lab Sample ID:	W10050B1	Sample Matrix:	WATER	Date Analyzed:	10/09/90
Client Sample ID:	QC BLANK	Percent Moisture:		Dilution Factor:	1.0

TCLP HERBICIDE COMPOUNDS

CAS Number		ug/L		CAS Number	ug/L
94-75-7	2,4-D	100	U		
93-72-1	Silvex	10	U		
	3,5-Dichlorobenzoic acid - SS	97			

U - Analyzed for but not detected.
B - Detected in QC blank.
JX - Detected, concentration estimated.
SS - Surrogate Standard reported as percent recovery.

Form I

JHS

000057

CH2M HILL Montgomery Environmental Laboratory 2567 Fairlane Drive, P.O. Box 230548 Montgomery, Alabama 36116 205.271.1444

Engineers
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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 05-DC-01 1535 GRAB LG85167
Laboratory Sample Number: 16874001 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	1000	ug/L	10/10/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/03/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/10/90
pH, Solid	SW9045	----	5.4	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: ____________

INRPRPT(v900202)

CH2M HILL Quality Analytical Laboratories 2567 Fairlane Drive, P.O. Box 230548 Montgomery, Alabama 36116 205 271 1444

Engineers
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Scientists

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 05-DC-02 1543 GRAB LG85168
Laboratory Sample Number: 16874002 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	590	ug/L	10/10/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/03/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	200	ug/L	10/10/90
pH, Solid	SW9045	----	5.1	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000059

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CH2M HILL

REPORT OF ANALYTICAL RESULTS

Date: 10/31/90

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Atten: MR. DON HASH

Sample Description: 05-DC-03 1547 GRAB LG85169
Laboratory Sample Number: 16874003 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	370	ug/L	10/10/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/03/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/10/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/10/90
pH, Solid	SW9045	----	5.0	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: ________

INRPRPT(v900202)

000060

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CH2M HILL

REPORT OF ANALYTICAL RESULTS

Date: 10/31/90

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 05-DC-04 1552 COMP LG85170
Laboratory Sample Number: 16874004 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	610	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/03/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	--	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.5	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000061

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CH2M HILL

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 07-DC-01 1559 GRAB LG85171
Laboratory Sample Number: 16874005 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	950	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	57	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.9	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: ____________

INRPRPT(v900202)

000062

CH2M HILL Engineers Planners Economists Scientists

REPORT OF ANALYTICAL RESULTS

Date: 10/31/90

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 08-DC-01 1604 COMP LG85172
Laboratory Sample Number: 16874006 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	620	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.2	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: ____________

INRPRPT(v900202)

000063

CH2M HILL Engineers Planners Economists Scientists

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 09-DC-02 1607 GRAB LG85173
Laboratory Sample Number: 16874007 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	460	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.8	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000064

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 10-DC-01 1617 COMP LG85174
Laboratory Sample Number: 16874008 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	410	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.2	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: [signature]

INRPRPT(v900202)

CH2M HILL Quality Analytical Laboratories 2567 Fairlane Drive, P O Box 230548, Montgomery, Alabama 36116 205 271 1444

CH2M HILL Engineers Planners Economists Scientists

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 11-DC-01 1623 GRAB LG85175
Laboratory Sample Number: 16874009 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	640	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	220	ug/L	10/11/90
pH, Solid	SW9045	----	6.2	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000065

CH2M HILL
Engineers
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REPORT OF ANALYTICAL RESULTS

Date: 10/31/90
Page: 10 of 12

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: 11-DC-02 1628 GRAB LG85176
Laboratory Sample Number: 16874010 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	240	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.6	<0.6	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.4	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000067

Engineers
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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: DECON AREA W. WASTE 1632 COMP LG85177
Laboratory Sample Number: 16874011 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	560	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	0.7	<0.7	mg/kg	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NON-IGNITABLE	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	5.7	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by:

INRPRPT(v900202)

000068

Engineers
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CH2M HILL

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LGN
7201 N.W. 11TH PLACE
GAINESVILLE, FL 32605

Atten: MR. DON HASH

Project Number: SEF27794.C0.02
GEORGIA AIR NATIONAL GUARD
Laboratory Number: 16874
Date Received: 09/25/90

Sample Description: METHOD BLANK
Laboratory Sample Number: 16874ZS1 Date Collected: 09/25/90 Matrix: SOIL BLANK

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
TCLP Silver	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Arsenic	EPA206.2/SW7060	10	<10	ug/L	10/09/90
TCLP Barium	EPA200.7/SW6010	200	<200	ug/L	10/11/90
TCLP Cadmium	EPA200.7/SW6010	5	<5	ug/L	10/12/90
Cyanide, Distilled	EPA335.2	5.0	<5.0	ug/L	10/05/90
TCLP Chromium	EPA200.7/SW6010	10	<10	ug/L	10/11/90
TCLP Mercury	EPA245.1/SW7470	0.2	<0.2	ug/L	10/10/90
Ignitability	SW846(1C):7.1	----	NA	----	10/11/90
TCLP Lead	EPA200.7/SW6010	100	<100	ug/L	10/11/90
pH, Solid	SW9045	----	NA	units	10/08/90
Sulfide	EPA376.1/376.2	2.0	<2.0	mg/Kg	10/10/90
TCLP Selenium	EPA270.2/SW7740	25	<25	ug/L	10/11/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

COMMENT: NA = NOT APPLICABLE.

Reviewed by: ____________

INRPRPT(v900202)

CH2M HILL Quality Analytical Laboratories 2567 Fairlane Drive, P.O. Box 230548 Montgomery, Alabama 36116 205 271 1444

Engineers
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CASE NARRATIVE
General Chemistry
27760

I. Holding Time: All criteria met.

II. Analysis:

A. Calibration: Acceptance criteria met.
B. Blanks: Acceptance criteria met.
C. Matrix Spike: Acceptance criteria met.
D. Duplicate Analysis: Acceptance criteria met.
E. Lab Control Sample: Acceptance criteria met.
F. The Nitrate results are reported as N. To convert to Nitrate as NO3 multiply the result by 4.43.
G. Other: None.

III. I certify that this data package is in compliance with the terms and conditions agreed to by the client and CH2M HILL, both technically and for completeness, for other than the conditions detailed above.

SIGNED: Randall Wright DATE: 10/12/96
Randall L. Wright
General Chemistry Supervisor

000070

CH2M Engineers Planners Economists Scientists

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 05-DC-01 LM16874001
Laboratory Sample Number: 27760001 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 05-DC-02 LM16874002
Laboratory Sample Number: 27760002 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 05-DC-03 LM16874003
Laboratory Sample Number: 27760003 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. E. Hawley

INRPRPT(v900202)

000073

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 05-DC-04 LM16874004
Laboratory Sample Number: 27760004 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 07-DC-01 LM16874005
Laboratory Sample Number: 27760005 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

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REPORT OF ANALYTICAL RESULTS

Date: 10/12/90

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 08-DC-01 LM16874006
Laboratory Sample Number: 27760006 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 09-DC-02 LM16874007
Laboratory Sample Number: 27760007 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 10-DC-01 LM16874008
Laboratory Sample Number: 27760008 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)
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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 11-DC-01 LM16874009
Laboratory Sample Number: 27760009 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: 11-DC-02 LM16874010
Laboratory Sample Number: 27760010 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

000080

CH2M Engineers Planners Economists Scientists

REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: DECON AREA WASTE LM16874011
Laboratory Sample Number: 27760011 Date Collected: 09/22/90 Matrix: SOIL

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

000081

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REPORT OF ANALYTICAL RESULTS

Client: CH2M HILL/LMG
2567 FAIRLANE DR.
P.O. BOX 230548
MONTGOMERY, AL 36123-0548
Atten: MS. EMILY RAMUCHAK

Project Number: SEF27794.C0.02
GEORGIA AIR NAT'L. GUARD
Laboratory Number: 27760
Date Received: 10/05/90

Sample Description: METHOD BLANK
Laboratory Sample Number: 27760ZS1 Date Collected: 10/05/90 Matrix: SOIL BLANK

Analytical Parameter	Method	Det Limit	Result	Units	Ana Date
Sulfide, Extractable	EPA376.1(MOD)	2.0	<2.0	mg/Kg	10/10/90

Results for non-aqueous matrices are based on dry sample weight unless noted otherwise.

Reviewed by: J. Hawley

INRPRPT(v900202)

CH2M HILL Redding Environmental Laboratory, 5090 Caterpillar Road, Redding, California 96003 916.244.5227

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

TO LIM

IGNIT S, CADD pH SOL (good) TCLP

call to Ling

PROJECT NUMBER	SEF27794.C0.02
PROJECT NAME	Georgia Air Nat'l Guard
CLIENT NAME	HAZWRAP /GANG
PROJECT MANAGER	Mark Morris /DFB
COPY TO:	Rik Olson /DFB
REQUESTED COMP. DATE	STANDARD
SAMPLING REQUIREMENTS	SDWA ☐ NPDES ☐ RCRA ☐ OTHER HAZWRAP
CLIENT ADDRESS AND PHONE NUMBER	

ANALYSES REQUESTED: HAZARDOUS WASTE CHARACTERISTICS (2-8oz glass jars); Ignitability; Reactivity; Corrosivity; TCLP

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	HAZARDOUS WASTE CHARACTERISTICS		LAB ID	REMARKS
01	9/22	1535		✓		05-DC-01		2	851 67	001	I'll call you monday morning 9/24 with more details regarding parameters.
02		1543		✓		05-DC-02		2	68	002	
03		1547		✓		05-DC-03		2	69	003	
04		1552	✓			05-DC-04		2	70	004	
01		1559		✓		07-DC-01		2	71	005	
01		1604	✓			08-DC-01		2	851 72	006	
02		1607		✓		09-DC-02		2	73	007	* QC Level I confirmed by Don Nash to S. Hamid AHS 9/25/90
01		1617	✓			10-DC-01		2	74	008	
01		1623		✓		11-DC-01		2	75	009	
02		1628		✓		11-DC-02		2	76	010	
DAW	↓	1632	✓			DECON AREA WASTE		2	851 77	011	Results to Don Nash
						Method blank				ZS1	Due ~~10-5-90~~ 10-12-90
						Total 22 Jars 9/22	22				QC level 1 (per Don Nash) ~~QC level 2H~~

FOR LAB USE ONLY (stamp)
LAB# 16874
PROJ# SEF27794.C0.02
ACK ER 9/27 VERIFIED DFS 9/26/90
HAZWRAP/NEESA Ⓨ
QC LEVEL ①
COC Yes ICE Melted
ANA REQ Yes TEMP 20°C
CUST SEAL No PH NA
SAMPLE COND. Soil

SAMPLED BY AND TITLE: Jon Jurgy ESC	DATE/TIME 9/22/90, 1640	RELINQUISHED BY: Jon Jurgy	DATE/TIME 9/22/90, 1700
RECEIVED BY:	DATE/TIME	RELINQUISHED BY: M. Morgan	DATE/TIME 9-24-90 1650
RECEIVED BY: AA Silco	DATE/TIME 9/25/90 0900	RELINQUISHED BY:	DATE/TIME
RECEIVED BY LAB: M. Morgan	DATE/TIME 9-24-90 1610	SAMPLE SHIPPED VIA UPS BUS FED-EX HAND OTHER	AIR BILL# 632 896 4480
REMARKS		033 4/13 203 0 501	

FOR LAB USE ONLY

LAB# 16874			
LAB#			
PROJECT NO. SEF27794.C0.02			
ACK	VERIFIED		
QUOTE#	BS		
NO. OF SAMP	PG 1	OF 1	

HAZWRAP/NEESA Ⓨ N			
QC LEVEL ① 2 3			
COC y	ICE		
ANA REQ y	TEMP		
CUST SEAL y	Ph		
SAMPLE COND. good / iced			
ENTERED INTO LIMS	COC REVIEWED 9/25/90		

A9PS4164

REV 5/89 FORM 340

000083

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

Send all to LMG

Dec 10/12/90

PROJECT NUMBER	PROJECT NAME	CLIENT ADDRESS AND PHONE NUMBER	FOR LAB USE ONLY
JEF27794.C0.02	Georgia Air Nat'l Guard		LAB# [illegible] 16894
CLIENT NAME: HAZWRAP / GANG			LAB#
PROJECT MANAGER: Mark Morris / DFB	COPY TO: Rik Olson / DFB		PROJECT NO.
REQUESTED COMP. DATE: STANDARD	SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER Hazwrap		ACK / VERIFIED
			QUOTE# / BS
			NO. OF SAMP / PG / OF

ANALYSES REQUESTED: Hazardous Waste Characteristics (2-8oz glass jars); Ignitability; Reactivity; Corrosivity; TCLP

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	HAZARDOUS WASTE CHARACTERISTICS (2-8oz glass jars)	LAB ID	REMARKS
01	9/22	1535		✓		05-DC-01		2	85167	I'll call you Monday
02		1543		✓		05-DC-02		2	68	morning 9/24 with
03		1547		✓		05-DC-03		2	69	more details regarding
04		1552	✓			05-DC-04		2	70	parameters.
01		1559		✓		07-DC-01		2	71	
01		1604	✓			08-DC-01		2	85172	
02		1607		✓		09-DC-02		2	73	
01		1617	✓			10-DC-01		2	74	
01		1623		✓		11-DC-01		2	75	
02		1628		✓		11-DC-02		2	76	
D.A.W.		1632	✓			DECON AREA WASTE		2	85177	
						Total ~~22~~ Jars (9/22)	22			QC level 1 (per Don Hash)
										~~QC level 2A~~

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME	
[signature] ESS	9/22/90, 1640	[signature]	9/22/90, 1700	HAZWRAP/NEESA (Y) N
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	QC LEVEL 1 2 3
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	COC y — ICE
				ANA REQ y — TEMP
				CUST SEAL y — PH
				SAMPLE COND. good / iced
RECEIVED BY LAB: M. Morgan	DATE/TIME 9-24-90 1610	SAMPLE SHIPPED VIA UPS BUS (FED-EX) HAND OTHER ____	AIR BILL# 632-8964480	
REMARKS			ENTERED INTO LIMS ____	COC REVIEW ____

REV 6/89 FORM 340

Engineers
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Economists
Scientists

October 17, 1990

SEF27794.C0

Mr. Del Long
Project Manager
Martin Marietta Energy Systems, Inc.
831 Tri-County Boulevard
Tri-County Mall
Oliver Spring, TN 37840

Dear Del:

Subject: Georgia Air National Guard--Response to Field Surveillance Comments (10-2-90 by C. Lutz) and Review of August Monthly Progress Report (9-27-90, R. Westmoreland).

On October 1 and October 10, 1990, CH2M HILL received copies of internal correspondence prepared by Martin Marietta Energy Systems (MMES), Inc., personnel. The documents presented comments on a Field Surveillance (performed by Mr. Charlie Lutz, 9-20-90) and the August Monthly Laboratory Progress Report prepared by CH2M HILL on September 4, 1990.

During the Field Surveillance, Mr. Lutz made five findings and four observations. According to Mr. Lutz's correspondence, the findings do not require a response while the observations may require a field change request or other appropriate action. Although findings require no official action, this letter will address both the findings and observations. The following is a sequential response to Mr. Lutz's comments. A copy of Mr. Lutz's and Mr. Westmoreland's comments are included following this letter so that each comment does not need to be restated.

FINDINGS

1. Noted and will be followed in the future.

2. DOE/HWP-69 states that sampling equipment used to collect samples for pesticide, PCB's, or fuel analysis should be rinsed with hexane following a methanol rinse. Since samples collected during the Site Investigation at

Georgia Air National Guard (GANG) were analyzed for Total Petroleum Hydrocarbons (TPH) it was agreed upon by Mr. Dan Oakley (HAZWRAP) and Mr. Rick Olson (CH2M HILL) that sampling equipment would be rinsed with hexane as part of the decontamination process. Because the SISAP did not state that equipment would receive a hexane rinse, a Field Change Request Form (FCRF) must be filed. An FCRF (Number 9) for this modification is included following this letter.

3. Noted and will be properly abandoned.

4. Because each well was developed using a transparent bailer, the need to check for floating product was performed from the first bailer during development rather than during a separate step as originally contemplated in the SISAP. An FCRF (Number 10) for this modified practice is included following this letter.

5. When the SI SAP was originally drafted, it was assumed that the monitor wells would be purged using a centrifugal pump. Because of their relatively small volume and low rate of recovery, it was determined that purging the wells with a bailer prior to sampling would be more efficient. It was also decided that unless a well was grossly contaminated with floating product, purging could be performed with the same bailer which would be used to sample the well for confirmatory analysis. Because the sampling bailer was introduced to the well during purging (removing in excess of 10 bailer volumes of groundwater) it was decided that the bailer did not need to remove an additional three bailer volumes to become further rinsed by groundwater. This procedure represents a slight change from the method outlined in the SI SAP. As such, an FCRF (Number 11) for this change is included following this letter.

OBSERVATIONS

1. On September 24, 1990, CH2M HILL personnel performed well development and cleaning on monitor well 09-MW-01 at Site No. 9. Cleaning the well was performed by pumping the well with a centrifugal pump to lower the groundwater level and then inserting a swab to physically remove the grease on the well's casing. The swab was constructed by wrapping absorbent pads on the end of one-inch PVC casing. This action was repeated using clean pads until no further grease was observed on the pad. Following the cleaning, the well was sampled for confirmatory analysis.

Although the grease was definitely observed within 09-MW-01 during the groundwater sampling, it is our belief that this may be a condition within the soil and groundwater. The well screen and casing were pressure and steam cleaned prior to their installation to avoid such a situation.

2. Labels were replaced to avoid bottle content confusion.

3. Master padlocks (No. 3990) keyed alike were installed on all 22 of the newly installed monitor wells. This activity was performed on October 3, 1990, when a round of water level measurements was performed on all new and existing wells, piezometers, and surface water bodies. During the surveillance of September 10, 1990, the locks had been ordered by the drilling subcontractor and were awaiting delivery.

4. Approximately half of the PVC well caps cracked shortly after being installed. This fact was brought to the drilling contractor's attention. New caps (manufactured by S.E.W.S.) were installed on October 3, 1990. The new caps contain a metal bottom flange and are less likely to crack.

Review comments were also prepared by Mr. Richard Westmoreland on CH2M HILL's August Monthly Laboratory Progress Report. Mr. Westmoreland had seven comments which he requested responses to in writing. Four of the comments addressed the field sampling approach while the final three were directed toward the laboratory.

The following responses address Mr. Westmoreland's comments on the field sampling issues; responses from the laboratory will be addressed in a future correspondence directly from the laboratory.

1. Field Blanks according to DOE/HWP-65 are samples of water used for decontamination and steam cleaning. At minimum, one sample from each event and each source is to be analyzed for all parameters that the field samples are being analyzed. During the SI at GANG, one source of water was used for all decontamination activities. This source was a spigot supplying municipal water at the driller's staging area. This source was sampled on May 24, 1990 and analyzed for TPH, PAH, Priority Pollutant Metals (unfiltered), and volatile compounds. Since the entire field exercise was considered one event, and only one source of water was used for decontamination, only one sample was analyzed (5-24-90, DW-Decon Water).

2. According to DOE/HWP-65, Equipment Rinsate Samples are produced during the final rinsate of field equipment during decontamination. Analyte-free water was used and is collected following the final rinse. Rinsate samples are collected daily, however, only samples from every other day are analyzed for all parameters.

   Samples from soil borings were collected June 26-29, 1990, for laboratory analysis. During this activity, Equipment Rinsate samples were unintentionally omitted on June 26 and 27, 1990. Rinsate samples were collected on June 28 and 29, 1990, with the sample collected on June 29, 1990 being sent to the laboratory for analysis. This omission, therefore, was corrected following June 27, 1990. The result was that one Equipment Rinsate Sample requiring laboratory analysis (June 27, 1990) was not collected.

3. Samples collected on June 28 and 29, 1990 were sent in one shipment on June 29, 1990. As a result, only one trip blank was necessary with this shipment.

4. Sample shipment was coordinated with CH2M HILL's receiving laboratory so that sample arrival was anticipated. In this manner, samples could be processed immediately upon their arrival. Additionally, samples were held for up to one day in a refrigerator at the CH2M HILL field office. Following this procedure, the number of trip blanks could be reduced, shipping costs could be reduced (due to more efficient cooler packing), and sample holding times could still be met.

   Although this comment is noted, no mention of the daily shipment was identified in HAZWRAP's field guide. However, an FCRF (Number 8) was prepared for this procedure.

The remainder of Mr. Westmoreland's comments will be addressed by the laboratory in a subsequent document.

Copies of Mr. Lutz's and Mr. Westmoreland's review comments and the FCRF's are provided following this letter for your review and reference. At some point during the field effort, we have discussed these FCRFs with you or Dan Oakley. The forms

require your signature to complete the process. I would ask that you provide a copy of the signed FCRFs for my records. If you have any additional comments or require further documentation please call me.

Very truly yours,

CH2M HILL

Mark S. Morris

Mark S. Morris, Ph.D., P.E.
Project Manager

dbt068/087.51

cc: Nancy Tuor/CH2M HILL/ORO
Greg McIntyre/CH2M HILL/DFB
Tom Emenhiser/CH2M HILL/GNV
Rick Olson/CH2M HILL/DFB

IR-07-319-0442 (5.1)

MARTIN MARIETTA

Internal Correspondence

RECEIVED
OCT 4 1 40 PM '90
HAZWRAP

MARTIN MARIETTA ENERGY SYSTEMS, INC.

October 2, 1990

Copy: Dan Oakley
Mark Morris

D. D. Long, HAZWRAP, Tri County Mall

Field Surveillance Report for Georgia Air National Guard Base, Savannah, Georgia

Quality Control Specialist: Charles T. Lutz

Surveillance Date: September 20, 1990

Contractor: CH2M Hill Southeast, Inc. (CH2M Hill), Deerfield Beach, Florida

Introduction

The purpose of the surveillance was to observe field activities associated with monitoring well sampling and to examine project documentation to insure compliance with applicable project documents, HAZWRAP guidelines, and accepted field methods. This was the first time the wells had been sampled since installation and development. The sampling I observed was at Site 9, the Current Fire Training Area. CH2M Hill personnel conducted field activities in a professional manner. The two samplers, Len Drago and Scott Holzgen, organized and coordinated their respective tasks well.

RECEIVED
OCT - 9 1990

I observed the following activities:

- water-level measurement
- well purging
- water sampling
- sample handling, packaging, etc.
- equipment decontamination
- equipment calibration

I examined the following documentation:

- well sampling records
- field logbooks
- chain-of-custody forms
- request for analysis forms

Summary

I made five findings and four observations during the surveillance. The findings do not require a response, as explained below. The observations should be addressed to the extent deemed appropriate by the HAZWRAP project manager and the contractor. Mr. Mark Morris, the CH2M Hill project manager, did not have copies of the July 1990 editions of "Quality Control Requirements for Field Methods," (DOE/HWP-69) or "Standard Operating Procedures for Site Characterizations," (DOE/HWP-100). Mr. Long provided him with copies.

Findings

1. Corrections to the field logbooks should include a single-line strike out, the initials of the person making the correction, and the date. Some of the corrections were done in this manner in the logbooks I examined, but many were incomplete. No response is necessary, but it is essential that CH2M Hill personnel make corrections completely and clearly each time.

2. The decontamination procedure deviates from the procedure outlined in the work plan. A hexane rinse is now included. Mr. Morris stated that this change was made by mutual agreement between HAZWRAP and CH2M Hill. No response is necessary, but I suggest that a field change request form be completed, if this has not already been done.

3. There is an open soil-vapor survey sampling point near MW-2. The work plan states that these sampling points will be grouted after the survey is completed. No response is necessary, but CH2M Hill must insure that this sampling point is grouted. Mr. Morris assured me that this would be done as soon as possible.

4. The work plan states that after water-level measurement and before purging, each well will be checked for floating product with an interface probe. The check for floating product was omitted from the sampling procedure. Mr. Long, Mr. Morris, and I discussed this and concluded that this step could be omitted without jeopardizing data quality, unless subjective evidence suggested that product was present. No response is necessary, but a field change request form should be completed.

5. The work plan states that after the well has been purged, the bailer will be filled three additional times before retrieving samples. This additional rinsing was omitted from the sampling procedure. Mr. Long, Mr. Morris, and I discussed this and concluded that it was excessive because the wells were purged using the bailer. If the wells had been purged using a pump, the rinsing would have been appropriate. No response is necessary, but a field change request form should be completed.

Observations

1. During purging of well MW-1, a dark, greasy substance collected on the outer surface and inside of the bailer. The presence of this substance was unexpected; the bailer had been thoroughly cleaned and decontaminated before use. All present at the site discussed this problem and concluded that the well should be swabbed, re-developed, and then sampled. Mr. Morris stated that this would be done as soon as possible.

2. Labels on two of the bottles containing decontamination liquids were smudged. I suggest that these be relabelled for clarity.

3. The wells have locking caps, but none of the well caps currently have padlocks. I suggest that padlocks be added for additional security.

4. A couple of the well caps had small cracks. I suggest that these caps be replaced.

Please call me if you should have any questions concerning the surveillance or this report.

Charles T. Lutz, K-1004D, MS-7440 (576-4402)

CTL:mpl

cc: D. B. Jones, HAZWRAP
C. T. Lutz
M. D. Nickelson, HAZWRAP
R. D. Westmoreland
Letter File
Project File - RC

IR-07-319-0442

MARTIN MARIETTA

SAVANNAH

5.1

Internal Correspondence

MARTIN MARIETTA ENERGY SYSTEMS, INC.

RECEIVED
OCT 1 10 35 AM '90
HAZWRAP

September 27, 1990

COPY FORWARDED
10-3-90 TO:
MARK MORRIS.
J 10/3/90

D. D. Long, HAZWRAP, Tri-County Mall

Review of CH2M HILL August Monthly Progress Report for Work at Savannah ANGB, Dated September 4, 1990

The following comments must be forwarded to the subcontractor Project Manager and addressed in writing.

1. None of the shipments contained any field blanks.

2. Only one of the shipments contained equipment rinsates.

3. The samples collected on June 28 did not contain a trip blank.

4. Samples are to be shipped daily and not held in the field.

The following comments have been copied to the laboratory and must be addressed in writing.

1. There are no comments and/or corrective actions taken when control charts show out-of-control conditions.

2. Some of these control charts show obvious trends that should initiate some form of corrective action.

3. The control chart for 601 volatile organics shows point number 59 as being below the 3 sigma limit, however, the accompanying report sheet shows this point as being acceptable.

If I can be of further help, call me.

R D Westmoreland

R. D. Westmoreland, K-1004D, MS-7440 (574-8072)

RDW:mpl

cc: D. B. Jones, HAZWRAP
R. D. Westmoreland
M. Wisdom, CH2M HILL Montgomery Laboratory
Laboratory File
Letter File
Project File - RC

FIELD CHANGE REQUEST FORM

Field Change No. 1

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

It is requested that brass (as well as stainless steel) fittings be permitted for use on Soil Organic Vapor sampling equipment. Fittings will include connectors on air sampling lines.

Reason for change:

Both types of fittings were currently installed on sampling equipment. Additionally, certain fittings were only available in brass.

Recommended disposition:

Continue to use both types of fittings (brass and stainless steel) on SOV sampling equipment.

Impact on present and completed work:

No impact on work quality.

Final Disposition:

Requested by:
Field/Project Manager: Janet Ledbetter / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

FIELD CHANGE REQUEST FORM

Field Change No. 2

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

Change in decontamination procedure of SOV vapor collection probe and slam bar. No TSP wash except where gross contamination is observed. Decontamination will consist of organic free water wash and methanol rinse between samples.

Reason for change:

SOV sampling is for field screening only. Samples are actually collected through teflon tubing (chemically inert) which is changed between sites and after each 10 samples. (or after gross contamination).

Recommended disposition:

Decontaminate slambar, probes, and fittings between sites with TSP, OFW, and methanol. Continue to decontaminate slambar and probe with OFW and methanol between each individual sampling point (no TSP).

Impact on present and completed work:

None identified as long as quality control - system blanks remain relatively free from contamination.

Final Disposition:

Requested by:
Field/Project Manager: Janet Ledbetter / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 3

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

Hand auger borings (to produce head-space samples) at sites 6 and 9 will be partially performed using post-hole diggers. Post holing will be performed to a depth of 6-8 inches to remove surface organics/vegatation.

Reason for change:

Post holing through surface material is faster than hand augering. Additionally, a slightly larger and more stable bore-hole is produced which is less likely to collapse.

Recommended disposition:

Continue to use post-hole diggers to remove surface material.

Impact on present and completed work:

Since post-hole diggers do not come into direct contact with the sample (sample collected using a 2-inch diameter hand auger), no impact is anticipated. Post hole diggers are decontaminated between sample points.

Final Disposition:

Requested by:
Field/Project Manager: Janet Ledbetter /Mark S. Morris

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 4

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order No. 18Be97777C, Task Order No. Y-01, CH2MHILL SEF27794

Applicable Document: Sampling and Analysis Plan

Description:

Decontamination of all down-hole drilling equipment will be performed using a water rinse, detergent wash followed by a steam rinse. A methanol rinse will be deleted from the decontamination procedure.

Reason for change:

A methanol rinse is not required in HAZWRAP document DOE/HWP-69.

Recommended disposition:

Delete methanol rinse from decontamination requirements as outlined in SI-SAP

Impact on present and completed work:

None-The requested decontamination method is in compliance with HAZWRAP document DOE/HWP -69.

Final Disposition:

Requested by:
Field/Project Manager: Janet Ledbetter /Mark S. Morris

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 5

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

The monitor well at Site No. 6 (06-MW-01) was installed using a hand-auger rather than with a drilling rig.

Reason for change:

The proper placement of the monitor well (as established from the field screening activities) would have required substantial tree removal in order to mobilize a drill rig. Since the water table was close to the surface, the we wel was easily installed using a hand-auger.

Recommended disposition:

This recommendation was reviewed with the HAZWRAP project hydrogeologist and mutually agreed upon. This installation technique should be considered an equal alternative.

Impact on present and completed work:

The modified well installation technique should cause no adverse impact on the project. Additionally, this technique was more cost effective than removing trees by Site No. 6.

Final Disposition:

Requested by:
Field/Project Manager: Rick Olson / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

FIELD CHANGE REQUEST FORM

Field Change No. 6

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order No. 18B~~e~~97777C, Task Order No. Y-01, CH2MHILL SEF27794

Applicable Document: Sampling and Analysis Plan

Description:

The soil boring for Site No. 6 was done with a hand auger rather than a drilling rig.

Reason for change:

The water table was located near the ground surface therefore a drilling rig was not needed.

Recommended disposition:

Since this change was reviewed with Dan Oakley, this one-time change should be permitted.

Impact on present and completed work:

No adverse impact on the project is anticipated.

Final Disposition:

Requested by:
Field/Project Manager: Rick Olson /Mark S. Morris

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 7

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

Based on the results of Phase I field work and an adjacent well boring, one well was moved from Site No. 1 to Site No. 11. Additionally, the background well for the base was placed upgradient from Site No. 9..

Reason for change:

Site No. 11 needed additional definition and existing wells in the vicinity of the site were unusable. The southernmost well proposed at Site No. 1 was determined to be unnecessary due to initial screening and unfavorable geology.

Recommended disposition:

These changes were discussed with HAZWRAP's hydrogeologist and mutually agreed upon. As a result, only two wells were installed at Site No. 1 while 3 wells were installed at Site No. 11.

Impact on present and completed work:

These changes follow the philosophy of the investigation. Data is supplied at sites where it is needed and redundant or unnecessary data collection is avoided.

Final Disposition:

Requested by:
Field/Project Manager: Rick Olson / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

FIELD CHANGE REQUEST FORM

Field Change No. 8

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order No. 18B~~e~~97777C, Task Order No. Y-01, CH2MHILL SEF27794

Applicable Document: Sampling and Analysis Plan

Description:

Samples will be held in the field (refrigerated or on ice) for periods not to exceed 32 hours prior to shipment to the laboratory.

Reason for change:

By shipping samples every other day, field sampling activities will be more efficient, shipping costs will be reduced, and the total number of trip blanks will be reduced.

Recommended disposition:

Permit alternate day shipment

Impact on present and completed work:

No impact will be made on the project. Coordination will be assured through the laboratory to meet all sample holding times.

Final Disposition:

Requested by:
Field/Project Manager: Len Drago / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

FIELD CHANGE REQUEST FORM

Field Change No. 9

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

A change in the decontamination procedure used for ground and surface water sampling equipment is requested. The procedure outlined in the SI SAP will be modified to include a hexane rinse as directed by HAZWRAP personnel.

Reason for change:

HAZWRAP document DOE/HWP-69 Section 2.3.2.2 states that equipment used to sample for fuels analysis shall be decontaminated with methanol followed by a hexane rinse. The hexane rinse was not specified in the SI SAP.

Recommended disposition:

Decontamination procedure should be modified to include a hexane rinse following the methanol rinse.

Impact on present and completed work:

This modification will improve the quality of the test results and bring the decontamination into compliance with specified procedures.

Final Disposition:

Requested by:
Field/Project Manager: Len Drago / Mark S. Morris

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 10

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

No separate step will be performed to check for floating product prior to sampling monitoring wells.

Reason for change:

Because wells are purged using a bailer, any free product existing in the well would be observed. Additionally, no anticipation of free product exists following well installation and well development.

Recommended disposition:

After checking water level elevation, begin bailing wells to remove three well volumes of water. From the first bailer, observe for free floating product; no separate step necessary.

Impact on present and completed work:

None.

Final Disposition:

Requested by:
Field/Project Manager: Len Drago / Mark S. Mont

Approvals:
HAZWRAP Project Manager:

CH2M HILL

FIELD CHANGE REQUEST FORM

Field Change No. 11

Project Georgia Air National Guard, Savannah, Georgia

Project No. General Order 18B-97777C, Task Order Y-01; CH2M HILL SEF27794

Applicable Document: Site Investigation - Sampling and Analysis Plan

Description:

The sampling bailer will be used to purge the monitor wells of three well volumes of groundwater. Following purging, groundwater samples will be collected immediately from the bailer - no introduction of the bailer is necessar

Reason for change:

Original purging techniques considered the use of a pump. In this situation, it would have been necessary to introduce the bailer by removing three bailer volumes prior to sampling. However, the bailer was used to develop the wells.

Recommended disposition:

Delete the requirement to remove three well volumes plus three bailer volumes prior to sampling and replace with three well volumes using the sampling bailer. Bailer has been introduced to the groundwater during purging.

Impact on present and completed work:

None.

Final Disposition:

Requested by:
Field/Project Manager: Len Drago / Mark S. Mont

Approvals:
HAZWRAP Project Manager:

TECHNICAL MEMORANDUM CH2M HILL

TO: Rick Olson/DFB
Ross Sproul/DFB
Jane Tappen/DFB

COPIES: Mark Morris/DFB
Greg McIntyre/DFB

FROM: Peter Kwiatkowski/DFB

DATE: February 18, 1991

SUBJECT: Slug Tests Conducted at Georgia Air National Guard, Savannah, Georgia

PROJECT: SEF27794.C0

INTRODUCTION

Slug tests were conducted by CH2M HILL on October 1, 1990, at the Georgia Air National Guard Base near Savannah, Georgia. Ten wells were tested at nine sites to determine estimates of hydraulic conductivity (K). Hydraulic conductivity is a measure of a porous medium's ability to transmit water. The K values can then be used to calculate groundwater velocity at each site. In general, slug tests yield order-of-magnitude estimates of hydraulic conductivity in the immediate vicinity of the well. The Bouwer and Rice (1976) method was used to analyze the slug test data.

The K values derived from this analysis range from 3.5 to 515.4 ft/day (1.25×10^{-3} to 1.82×10^{-1} cm/sec). These values are generally consistent with the lithology (predominantly sands) encountered during well installation. High K values were determined at Monitor Wells 06-MW-01 and 09-MW-04 and may be due to the influences of the filter pack material. This technical memorandum summarizes the construction of the tested monitor wells; the methodology used in the slug tests; the analysis of the slug test data, including the equations used to calculate the K values; the results of the analysis, and the interpretation of the K values. The semi-log graphs and field data from the data logger are attached to this technical memorandum.

WELL CONSTRUCTION

Monitor wells installed as part of the site investigation (SI) were drilled by the hollow-stem auger method with a nominal, 10-inch outside-diameter (O.D.) auger. Two-inch-diameter, polyvinyl chloride (PVC) wells were constructed with approximately 10 feet of 0.010-inch (10

slot) screen and Schedule 40 PVC riser pipe to land surface. The screens were surrounded with 20/40 silica sand as filter pack material. Further details regarding well installation are contained in the SI Report.

METHODOLOGY

Static depth-to-water (SDTW) and total depth (TD) of each well were determined with an electronic water level data indicator (M-Scope) before testing began. A 30-psi pressure transducer was emplaced in each well. The transducer cable was connected to a HERMIT SE1000B data logger programmed to collect data at logarithmic intervals. Water column heights above the transducer (H_0) readings were then obtained. Table 1 is a summary of slug test field data and Bouwer and Rice (1976) parameters. Next, a 1-inch-diameter by 5-foot-long PVC solid slug was lowered into the well. After water levels had stabilized, the data logger was activated and the slug test was begun by rapidly removing the slug from the well. Water levels were then allowed to recover to their static levels. The slug was cleaned between tests by rinsing with deionized water, wiping with isopropanol, and rinsing again with deionized water.

Slug-in (falling water level) tests were not conducted because well screens straddled the water table in all of the monitor wells. Results of a slug-in test would therefore be a combination of saturated and unsaturated hydraulic conductivity above the water table.

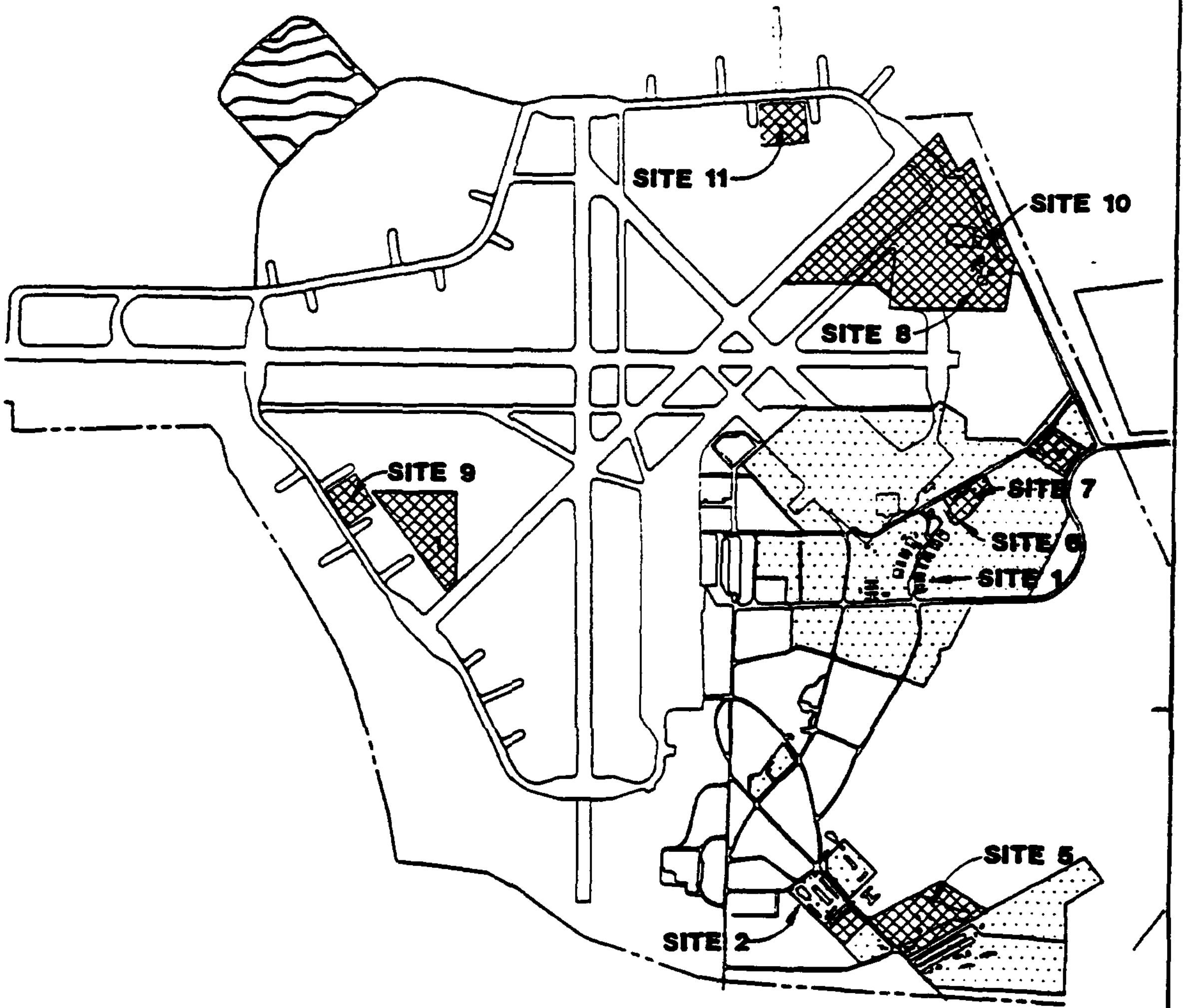
ANALYSIS

In the field, slug test data were transferred from the data logger to a portable computer using commercially available software. Data from each test were plotted on semi-log paper, and a "best-fit" line was drawn through the data points which conform to the assumptions of the Bouwer and Rice (1976) method. The graphs typically show a rapid decrease in water level early in the test and a less steep curve thereafter. This early decline is probably related to the influence of the filter pack. Therefore, the mid-to-late portions of the curve were used to draw the best fit lines to ensure actual aquifer response was measured. The semi-log graphs are attached to this memorandum.

Field data were analyzed using the Bouwer and Rice (1976) method because it is a relatively simple method, allows geometric control of well construction parameters, and is widely accepted in the hydrogeologic community for analysis of slug test data from partially penetrated wells in unconfined aquifers.

Figure 2 shows the variables and equations used in the Bouwer and Rice (1976) method. The term r_w is the borehole diameter (i.e. the O.D. of the auger--10 inches). Because the water table is below the top of the screen, L is only the length of screen below the static

02-27-90



165th TACTICAL AIR GROUP PROPERTY BOUNDARIES

PERMANENT FIELD TRAINING SITE (PFTS) PROPERTY BOUNDARIES

N

0 1200'

FIGURE 1

SITE LOCATION MAP
GEORGIA AIR NATIONAL GUARD BASE
SAVANNAH, GEORGIA

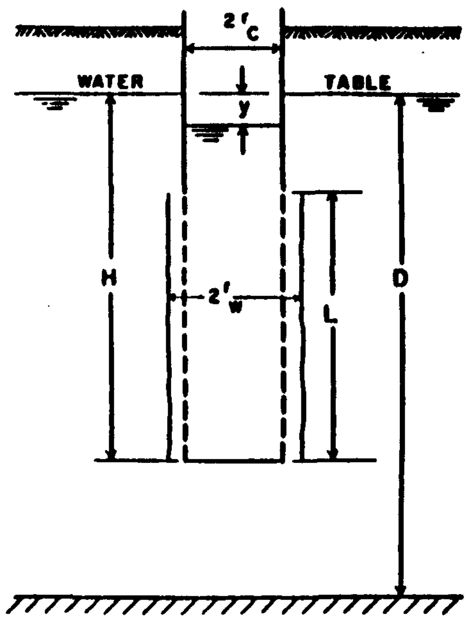
Table 1
Summary of Slug Test Field Data and Bouwer and Rice (1976) Parameters
Georgia Air National Guard Base
Savannah, Georgia
October 1, 1990

Well Number	Screened Interval (ft bls)	Total Depth (ft TOC)	SDTW (ft TOC)	Ho (ft)	L (ft)	r_w (ft)	r_{eq} (ft)	L/Rw	A	B
01-MW-01	3-13	13.0	4.65	6.94	8.35	0.416	0.238	20.07	2.15	0.25
02-MW-01	3-13	13.2	6.52	5.17	6.68	0.416	0.238	16.06	2	0.24
05-MW-02	3-13	13.2	5.88	3.86	7.32	0.416	0.238	17.60	2.05	0.24
06-MW-01	1.5-4.5	7.94	6.88	1.13	1.06	0.5	0.283	2.12	1.5	0.2
07-MW-01	2.5-12.5	12.7	3.51	7.93	9.19	0.416	0.238	22.09	2.2	0.25
08-MW-03	3-13	12.75	6.26	5.37	6.49	0.416	0.238	15.60	2	0.24
09-MW-03	4-14	13.76	7.69	5.23	6.07	0.416	0.238	14.59	2	0.24
09-MW-04	4.5-14.5	14.5	7.02	6.75	7.48	0.416	0.238	17.98	2.06	0.24
10-MW-01	8-18	18.0	12.36	5.01	5.64	0.416	0.238	13.56	1.95	0.24
11-MW-01	7-17	16.35	9.23	6.74	7.12	0.416	0.238	17.12	2.05	0.24

A = Bouwer and Rice (1976) empirical parameter
B = Bouwer and Rice (1976) empirical parameter
bls = Below land surface
Ho = Height of water column above transducer
L = Saturated length of well screen
r_{eq} = Equivalent radius for rising water level in well screen
r_w = Well boring radius
SDTW = Static Depth to water
TOC = Top of casing

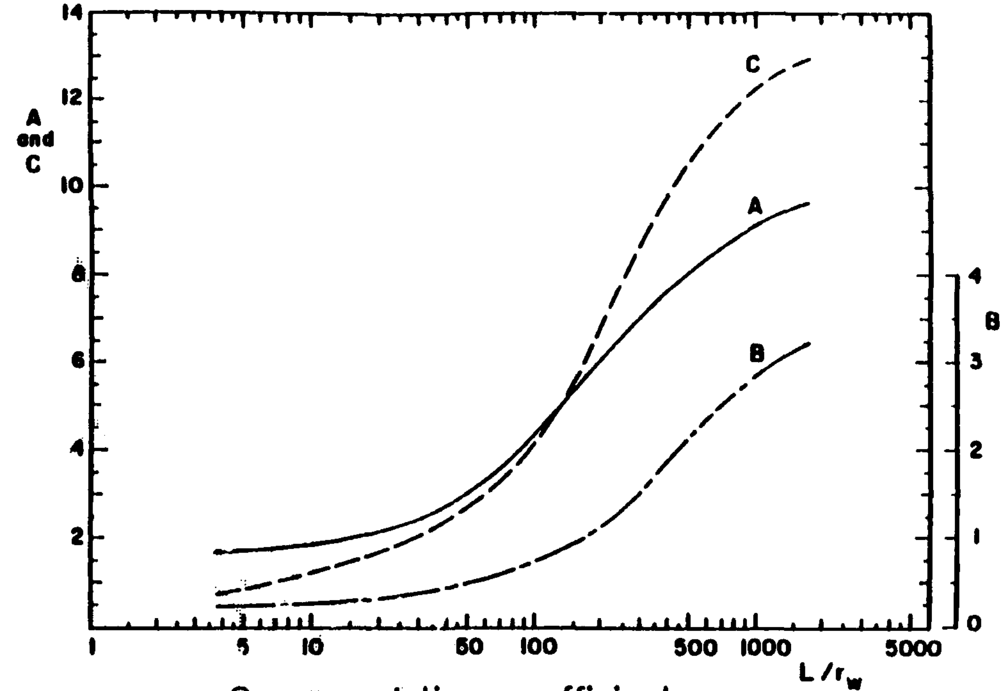
All wells are two-inch-diameter, PVC with No. 10 slot well screen
Well casing radius = 0.083 ft

Bouwer and Rice Method



Geometry and Symbols

Evaluation of R_e (expressed as: $\ln (R_e/r_w)$)



Curves relating coefficients A, B, and C to L/r_w

Case I: D >> H

$$\ln (R_e/r_w) = \left[\frac{1.1}{\ln (H/r_w)} + \frac{A + B\ln [(D-H)/r_w]}{L/r_w} \right]^{-1}$$

limiting value of $\ln [(D-H)/r_w] = 6$

Case II: D = H

$$\ln (R_e/r_w) = \left[\frac{1.1}{\ln (H/r_w)} + \frac{C}{L/r_w} \right]^{-1}$$

FIGURE 2

CH2M HILL

water table. Also, because no borings penetrated the total thickness of the surficial aquifer at the testing sites, an assumed aquifer thickness (D) of 100 feet based on literature data (Clarke et al., 1990) was used to adjust the results for partial penetration.

According to Bouwer (1989), if water levels rise within the well screen, the term r_c must be revised to take into account the filter pack according to the equation:

$$r_{eq} = [(1-n)r_c^2 + nr_w^2]^{1/2}$$

where:

r_{eq} = equivalent radius
n = porosity of the filter pack (approximately 30%)

Each monitor well's r_{eq} value, slope and y-intercept from the semi-log graph, and other parameters were then substituted into the appropriate equation (see Figure 2) to determine K. All parameters, empirical coefficients, and calculated K values are shown on the attached graphs.

RESULTS

The K values for the tested monitor wells are shown in Table 2. The K values range from 3.5 to 515.4 ft/day (1.25 x 10^{-3} to 1.82 x 10^{-1} cm/sec). Relatively low K values were obtained at Monitor Wells 02-MW-01 (3.5 ft/day), 10-MW-01 (7.1 ft/day) and 11-MW-01 (6.8 ft/day). Very high K values were determined at Monitor Wells 06-MW-01 (331.7 ft/day) and 09-MW-04 (515.4 ft/day).

INTERPRETATION

The well boring log at Monitor Well 02-MW-01 indicates that very fine sand with lenses of sandy clay and clayey sand were present within the well's screened interval. These lower permeability materials would tend to lower the K value obtained from the slug test.

Lenses of clay were also found within the screened intervals of Monitor Wells 01-MW-01 (K value = 11.9 ft/day), 05-MW-02 (K value = 14.5 ft/day), 07-MW-01 (K value = 24.2 ft/day), and 08-MW-03 (K value = 19.2 ft/day). Relatively higher K values at Monitor Wells 07-MW-01 and 08-MW-03 may be due to fine-to-medium grained sands within the well's screened intervals versus the very fine sands within the screened interval of Monitor Well 02-MW-01. Relatively low K values were also obtained at Monitor Well 10-MW-01 (7.1 ft/day), which may be due to a two-foot silt layer from 14 to 16 feet below land surface (bls) within the well's screened interval. The low K value obtained at Monitor Well 11-MW-01

Table 2
Summary of Hydraulic Conductivity (K) Values from Slug Tests
Georgia Air National Guard Base
Savannah, Georgia
October 1, 1990

Well Number	Hydraulic Conductivity (K)	
	(cm/sec)	(ft/day)
01-MW-01	4.18E-03	11.9
02-MW-01	1.25E-03	3.5
05-MW-02	5.13E-03	14.5
06-MW-01	1.17E-01	331.7
07-MW-01	8.54E-03	24.2
08-MW-03	6.78E-03	19.2
09-MW-03	2.84E-02	80.5
09-MW-04	1.82E-01	515.4
10-MW-01	2.51E-03	7.1
11-MW-01	2.41E-03	6.8

(6.8 ft/day) may be due to the very densely packed, fine sands (hardpan) encountered in the well boring.

The relatively high K value determined at Monitor Well 09-MW-03 (80.5 ft/day) may be the result of a larger grain size (medium-grained sands) encountered in the well boring.

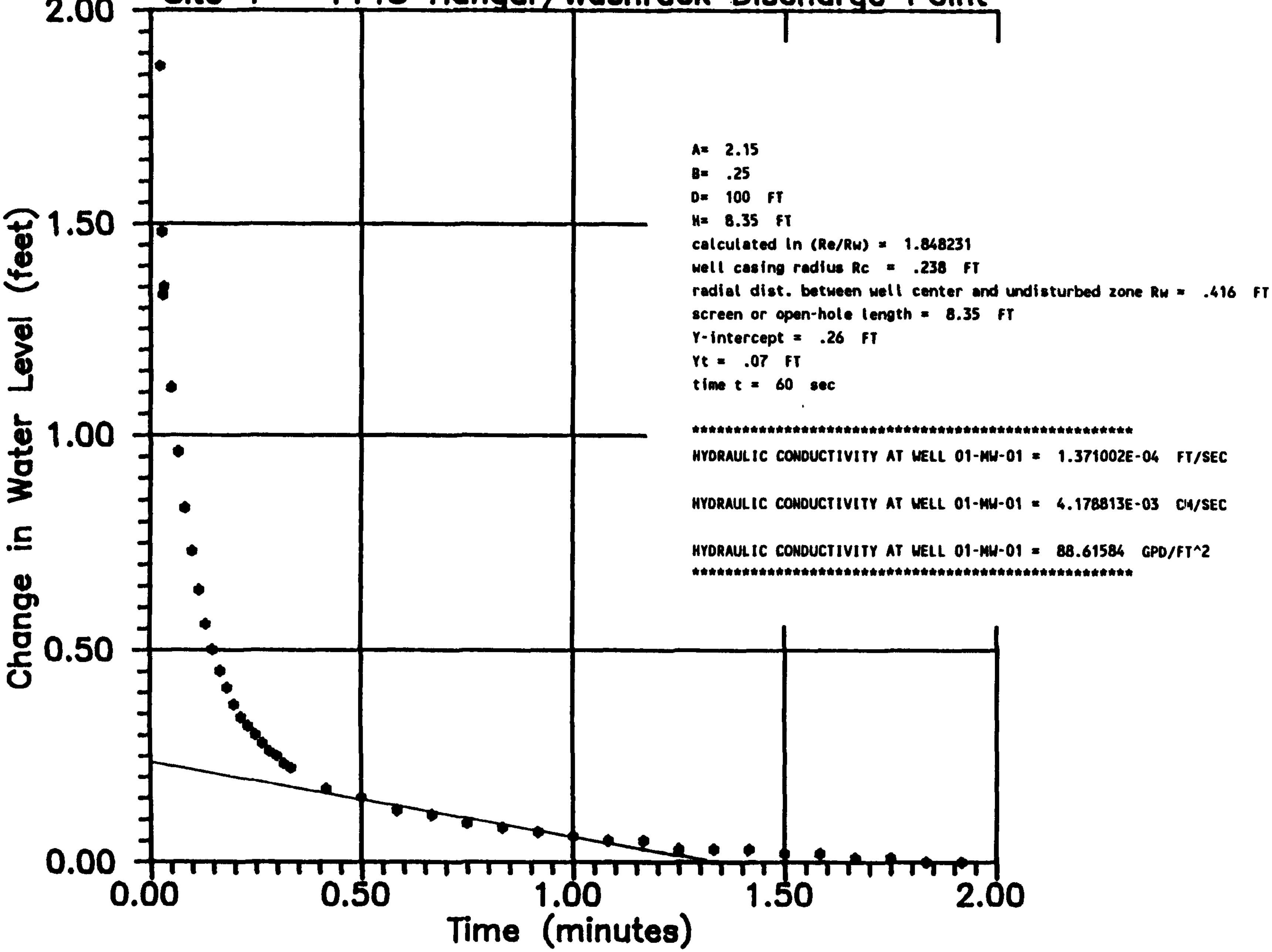
Very high K values were obtained at Monitor Wells 09-MW-04 and 06-MW-01. Field notes from well boring logs describe both of these well locations as having "highly permeable" sands. Because slug tests were conducted in a uniform manner, water levels in wells yielding high K values would respond more quickly to slug removal than other wells. The field data from the data logger and the Bouwer and Rice (1976) semi-log graphs for Monitor Wells 09-MW-04 and 06-MW-01 confirm this rapid response. In fact, water levels in Monitor Well 09-MW-04 returned to static conditions within 3 seconds following slug removal. Data within the first 3 seconds of a slug test may only show the effects of filter pack material around the well screen. A more reasonable K value to characterize Site 9 may be that for Monitor Well 09-MW-03 (80.5 ft/day).

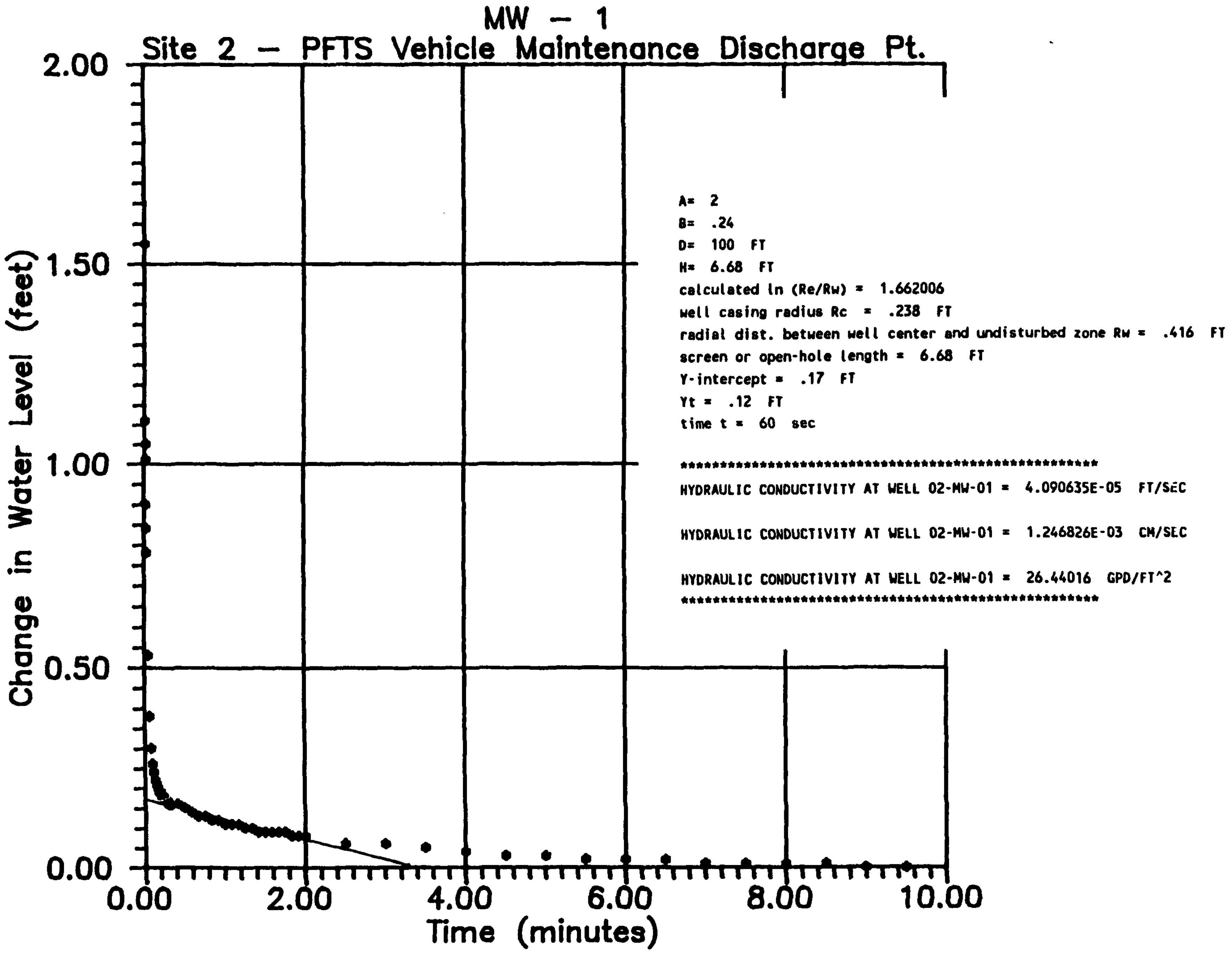
In addition to showing the quick response noted above, Monitor Well 06-MW-01 was not installed in the same manner as the other wells because the drill rig could not be mobilized into the woodlands. Instead, Monitor Well 06-MW-01 was installed in a hand-auger boring limited in depth to only a few feet. The screened interval for Monitor Well 06-MW-01 is 3 feet long, and the well had a water column height (H_0) of only 1.06 feet (see Table 1) at the time of the slug test. Thus, only 1 foot of aquifer was tested at Monitor Well 06-MW-01, and the well boring log indicated a relatively coarse sand in this interval. Also, because of the low (H_0) value for this well, changes in water level induced by the slug are of the same magnitude as (H_0), which may have also introduced some error in the K value obtained. Thus, K values obtained at Monitor Well 09-MW-04 and 06-MW-01 may not be as quantitatively valid as the others. In these cases, estimates of K should be made based on visual classification of the soils encountered.

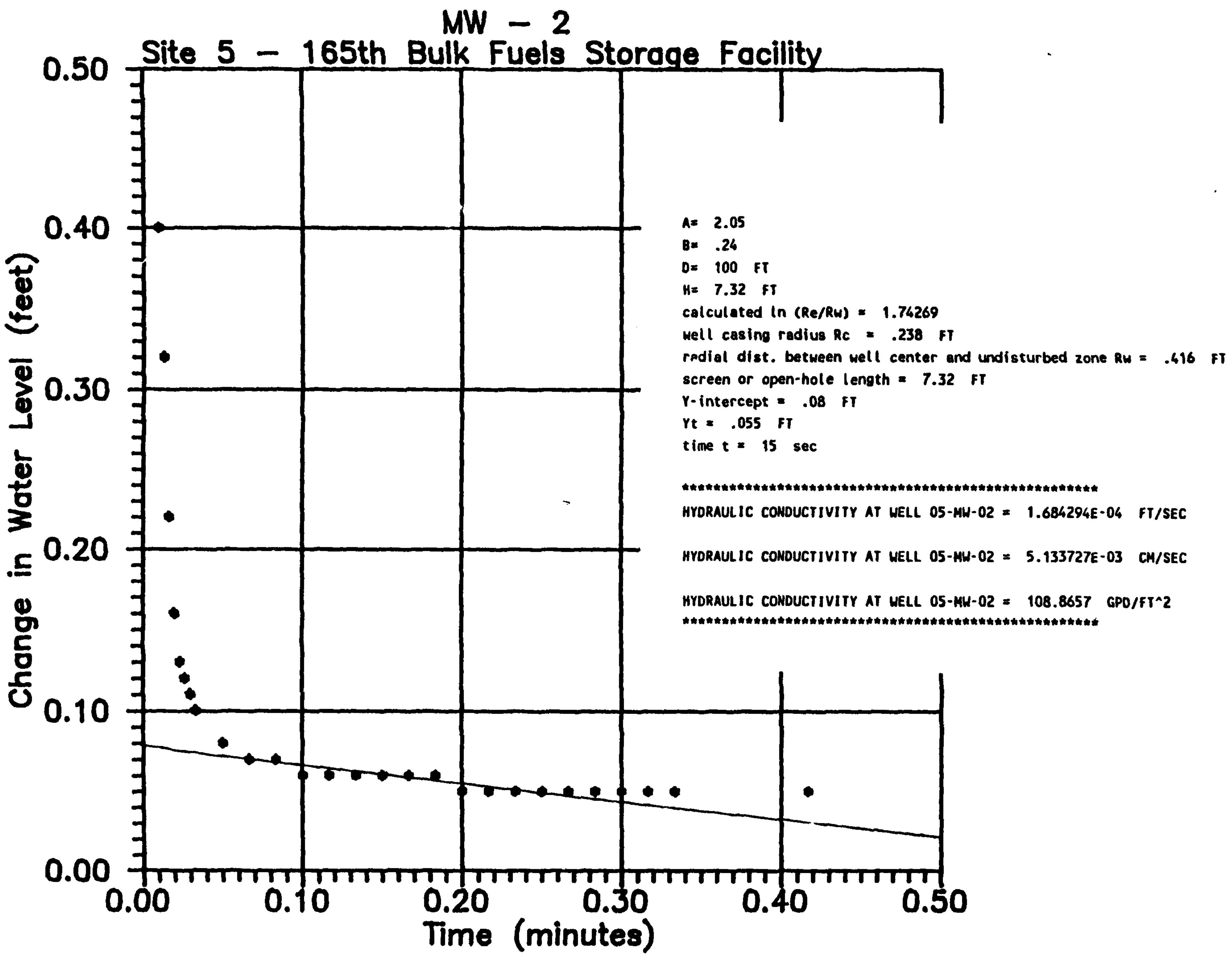
BOUWER AND RICE (1976) SEMI-LOG GRAPHS

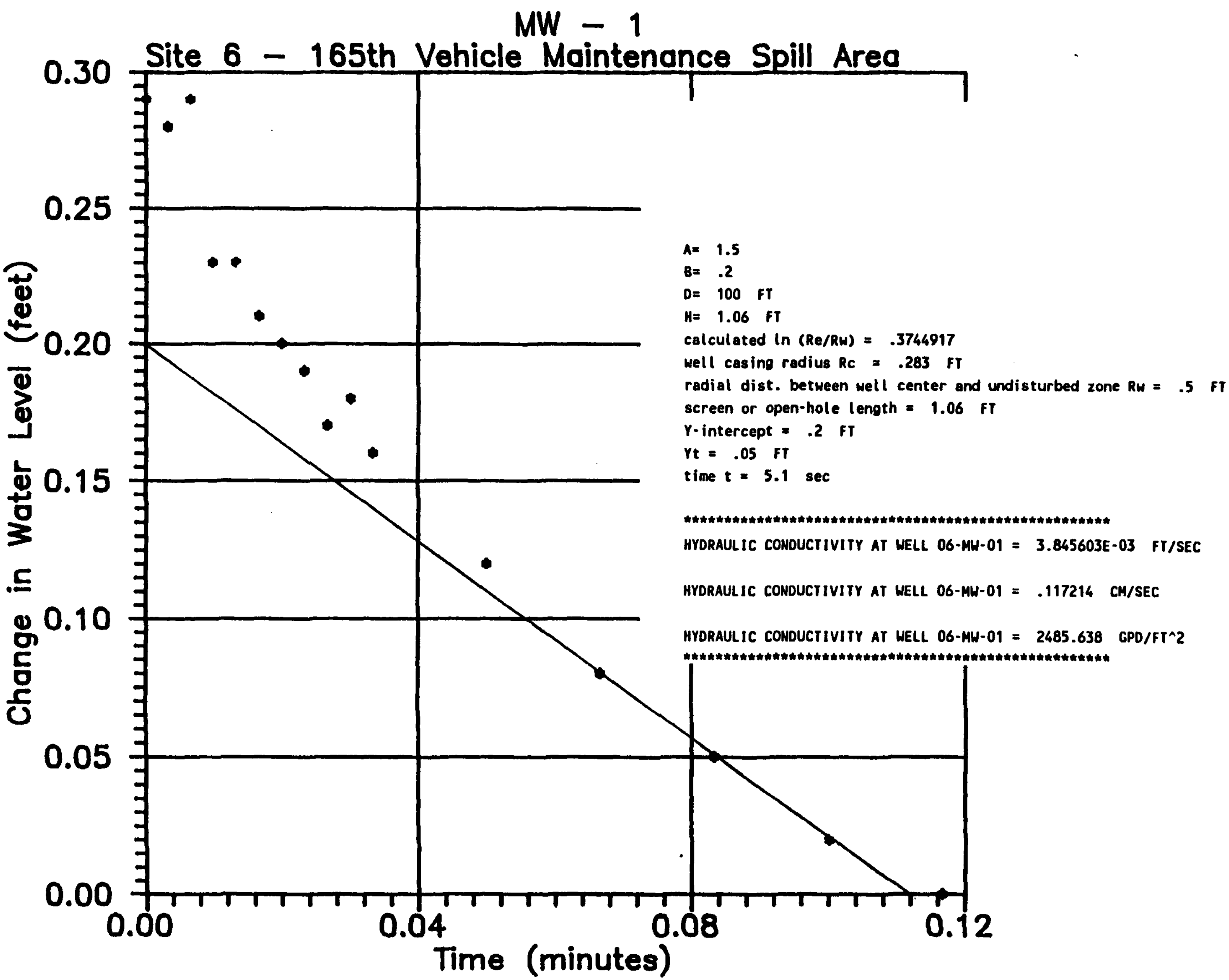
MW — 1

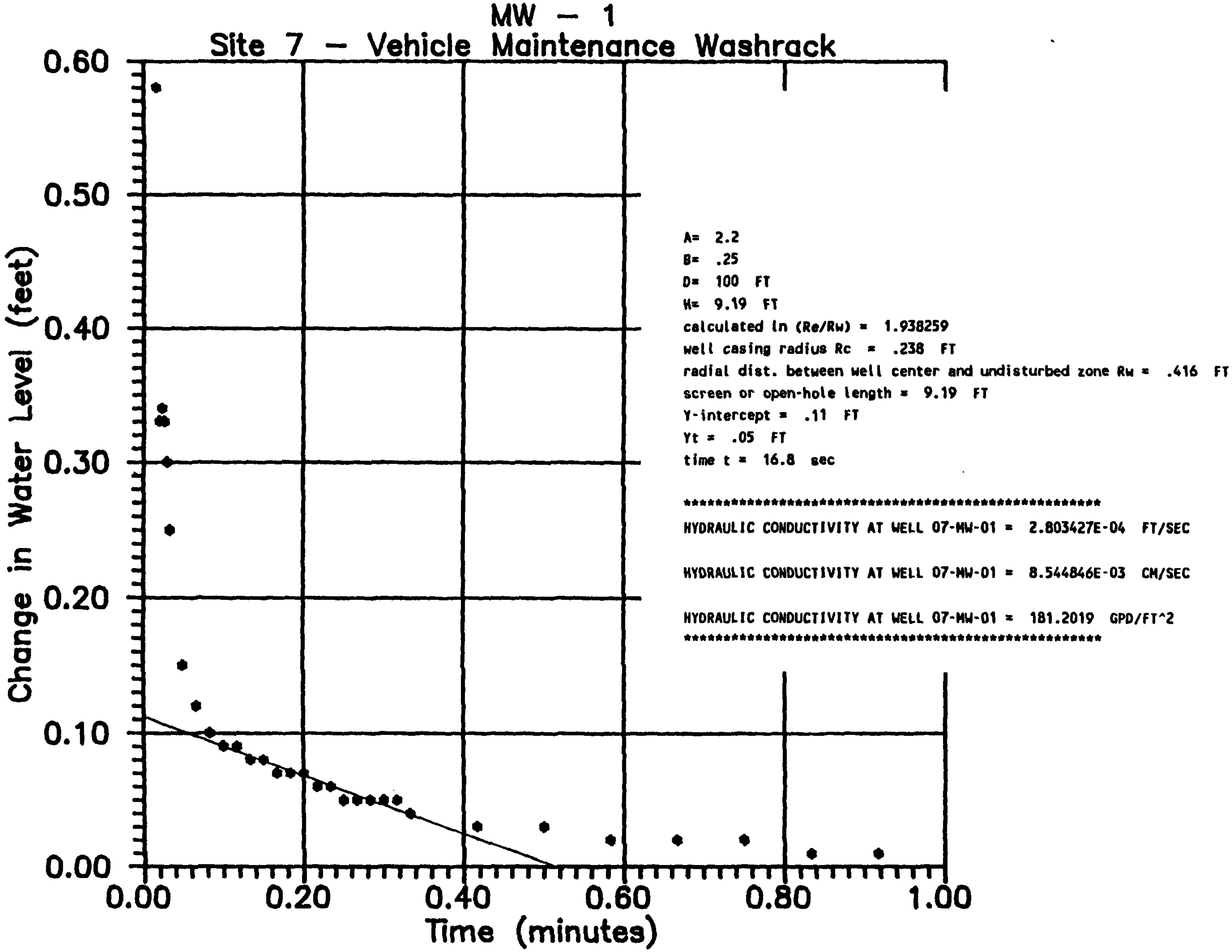
Site 1 — PFTS Hangar/Washrack Discharge Point

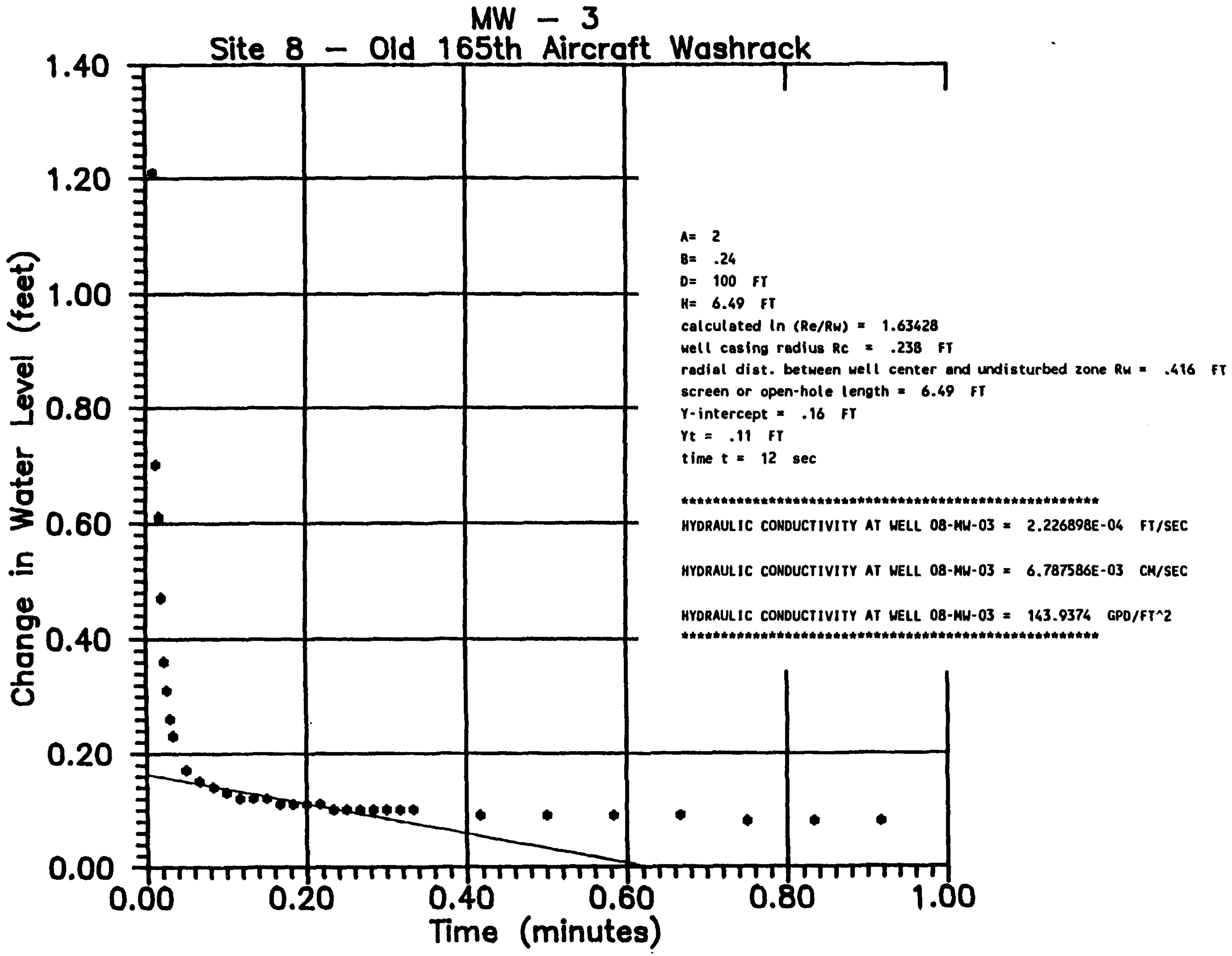


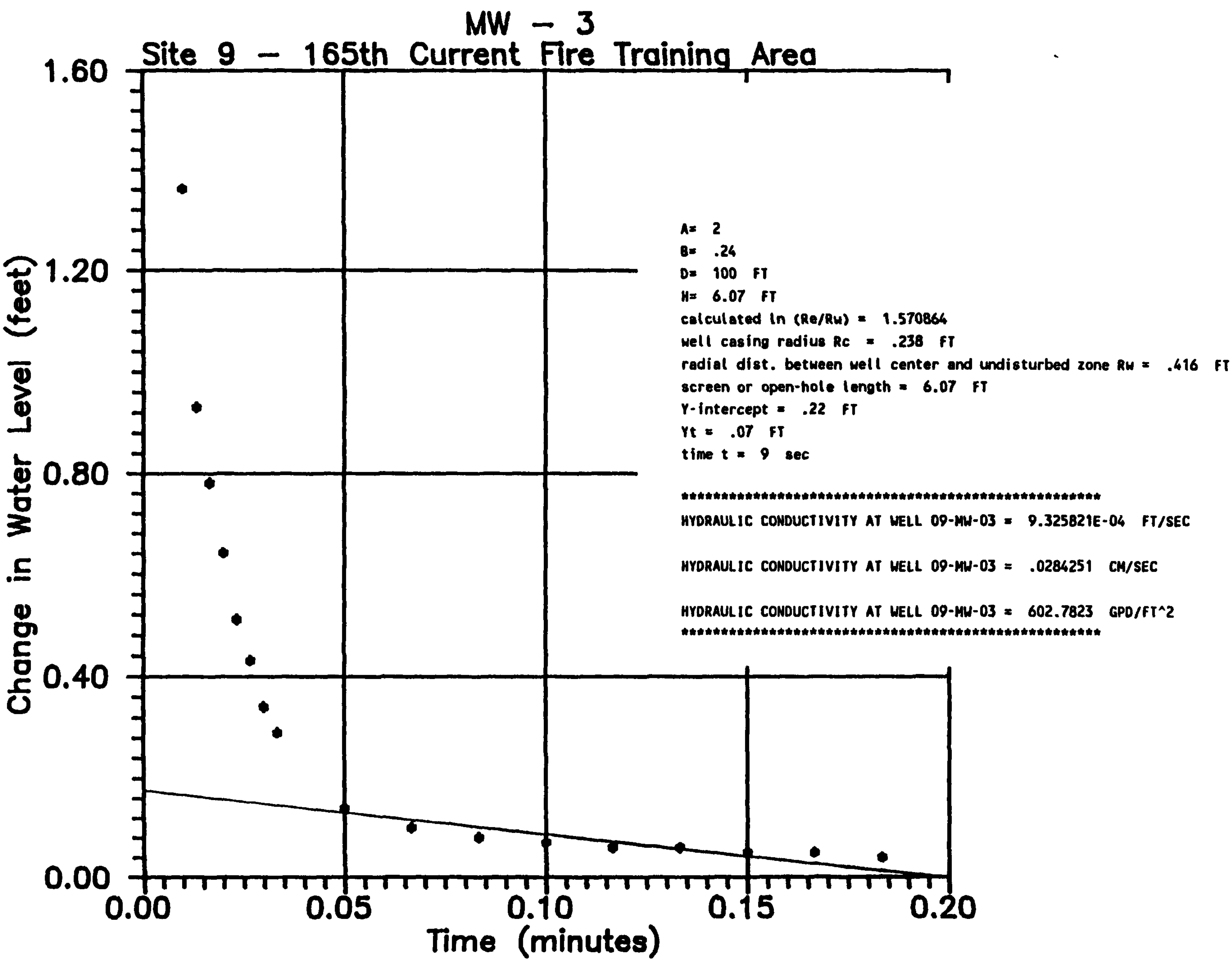

MW – 1
Site 2 – PFTS Vehicle Maintenance Discharge Pt.
Change in Water Level (feet)
2.00
1.50
1.00
0.50
0.00
0.00
2.00
4.00
6.00
8.00
10.00
Time (minutes)
A= 2
B= .24
D= 100 FT
H= 6.68 FT
calculated ln (Re/Rw) = 1.662006
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 6.68 FT
Y-intercept = .17 FT
Yt = .12 FT
time t = 60 sec
HYDRAULIC CONDUCTIVITY AT WELL 02-MW-01 = 4.090635E-05 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 02-MW-01 = 1.246826E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 02-MW-01 = 26.44016 GPD/FT^2

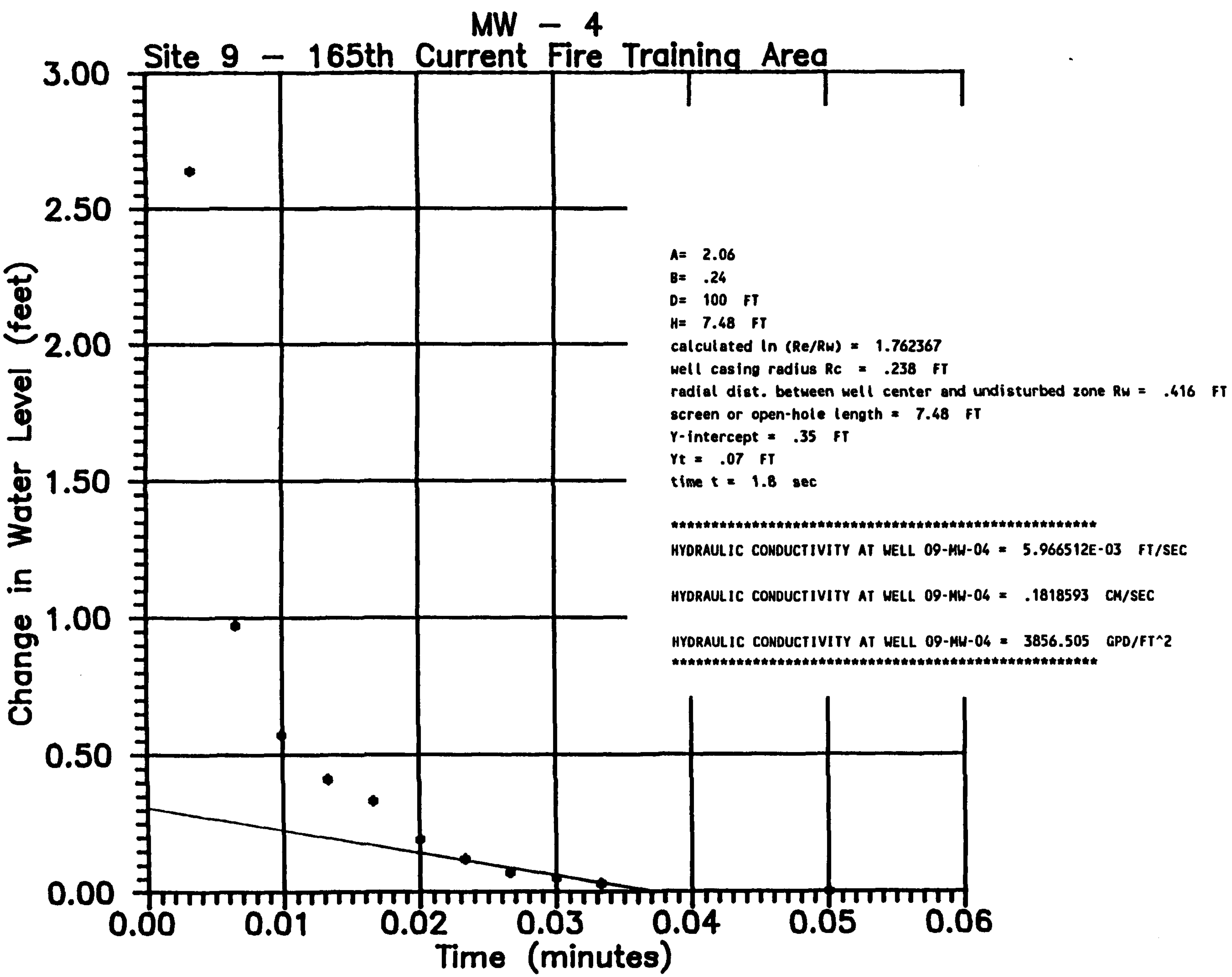

MW – 2
Site 5 – 165th Bulk Fuels Storage Facility
Change in Water Level (feet)
0.50
0.40
0.30
0.20
0.10
0.00
Time (minutes)
0.00
0.10
0.20
0.30
0.40
0.50
A= 2.05
B= .24
D= 100 FT
H= 7.32 FT
calculated ln (Re/Rw) = 1.74269
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 7.32 FT
Y-intercept = .08 FT
Yt = .055 FT
time t = 15 sec
HYDRAULIC CONDUCTIVITY AT WELL 05-MW-02 = 1.684294E-04 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 05-MW-02 = 5.133727E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 05-MW-02 = 108.8657 GPD/FT^2

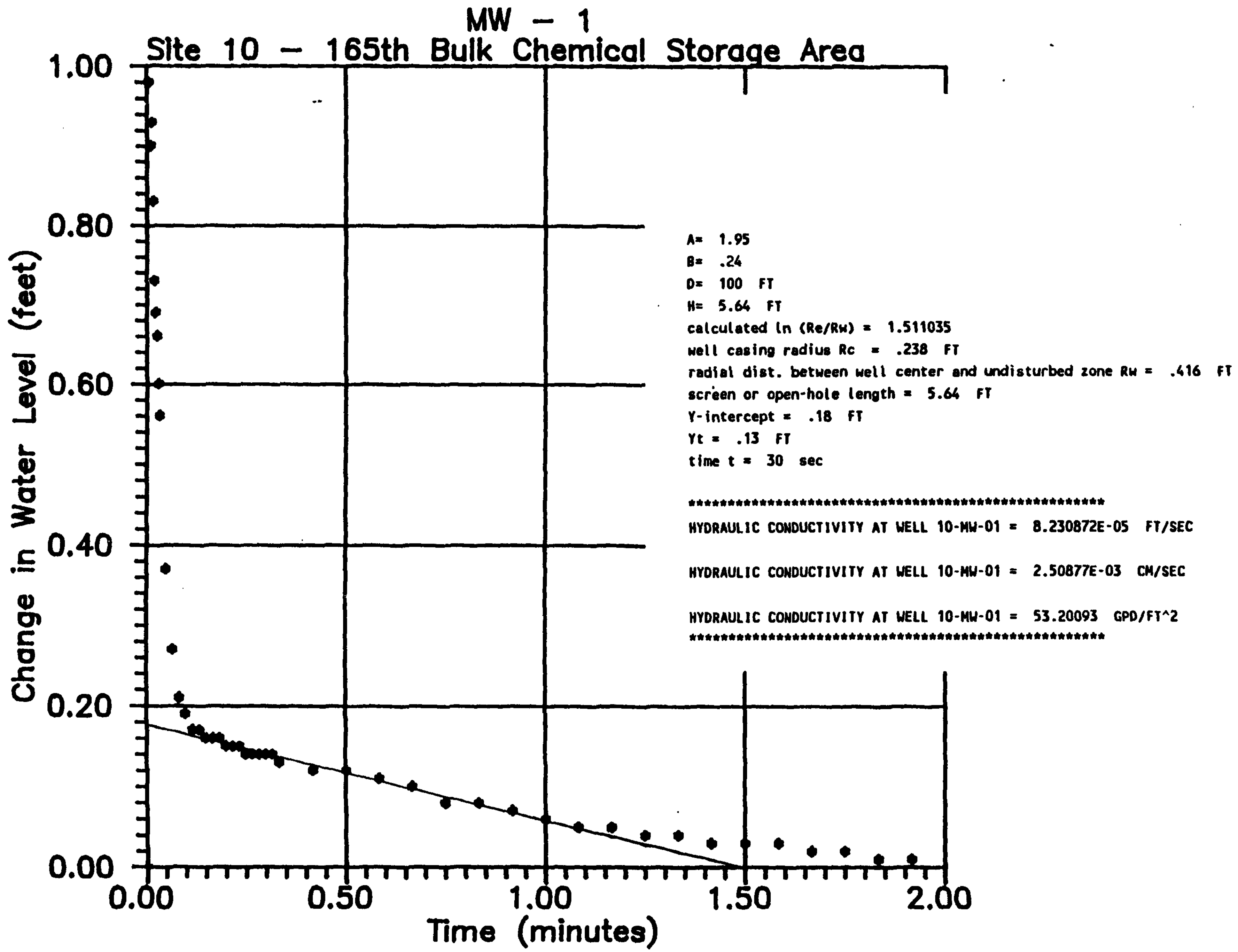

MW — 1
Site 6 — 165th Vehicle Maintenance Spill Area
Change in Water Level (feet)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.04
0.08
0.12
Time (minutes)
A= 1.5
B= .2
D= 100 FT
H= 1.06 FT
calculated ln (Re/Rw) = .3744917
well casing radius Rc = .283 FT
radial dist. between well center and undisturbed zone Rw = .5 FT
screen or open-hole length = 1.06 FT
Y-intercept = .2 FT
Yt = .05 FT
time t = 5.1 sec
HYDRAULIC CONDUCTIVITY AT WELL 06-MW-01 = 3.845603E-03 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 06-MW-01 = .117214 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 06-MW-01 = 2485.638 GPD/FT^2

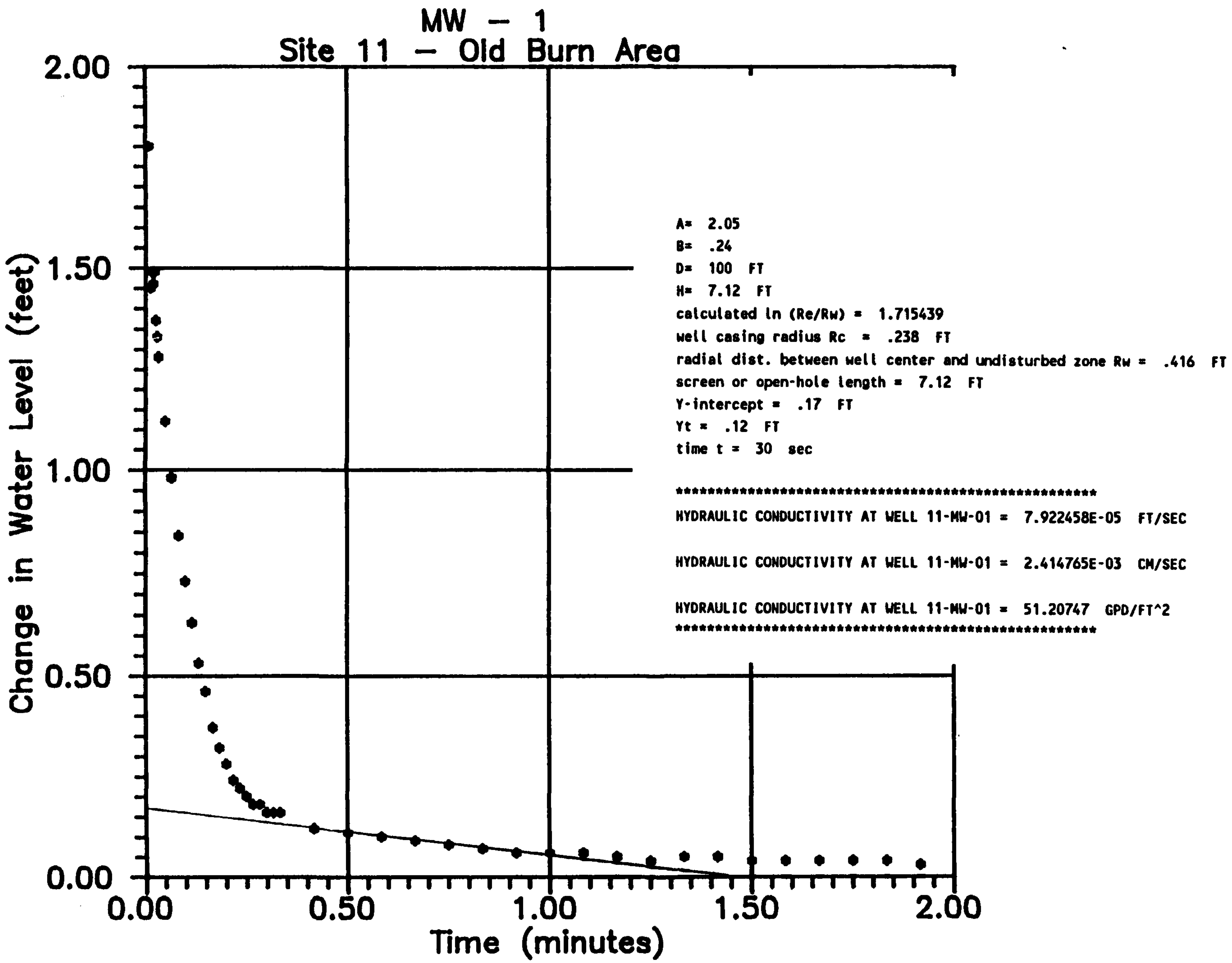

MW — 1
Site 7 — Vehicle Maintenance Washrack
Change in Water Level (feet)
Time (minutes)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
A= 2.2
B= .25
D= 100 FT
H= 9.19 FT
calculated ln (Re/Rw) = 1.938259
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 9.19 FT
Y-intercept = .11 FT
Yt = .05 FT
time t = 16.8 sec
HYDRAULIC CONDUCTIVITY AT WELL 07-MW-01 = 2.803427E-04 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 07-MW-01 = 8.544846E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 07-MW-01 = 181.2019 GPD/FT^2


MW — 3
Site 8 — Old 165th Aircraft Washrack
Change in Water Level (feet)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.20
0.40
0.60
0.80
1.00
Time (minutes)
A= 2
B= .24
D= 100 FT
H= 6.49 FT
calculated ln (Re/Rw) = 1.63428
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 6.49 FT
Y-intercept = .16 FT
Yt = .11 FT
time t = 12 sec
HYDRAULIC CONDUCTIVITY AT WELL 08-MW-03 = 2.226898E-04 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 08-MW-03 = 6.787586E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 08-MW-03 = 143.9374 GPD/FT^2


MW – 3
Site 9 – 165th Current Fire Training Area
A= 2
B= .24
D= 100 FT
H= 6.07 FT
calculated ln (Re/Rw) = 1.570864
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 6.07 FT
Y-intercept = .22 FT
Yt = .07 FT
time t = 9 sec
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-03 = 9.325821E-04 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-03 = .0284251 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-03 = 602.7823 GPD/FT^2
Change in Water Level (feet)
1.60
1.20
0.80
0.40
0.00
0.00
0.05
0.10
0.15
0.20
Time (minutes)


MW — 4
Site 9 — 165th Current Fire Training Area
Change in Water Level (feet)
Time (minutes)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.01
0.02
0.03
0.04
0.05
0.06
A= 2.06
B= .24
D= 100 FT
H= 7.48 FT
calculated ln (Re/Rw) = 1.762367
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 7.48 FT
Y-intercept = .35 FT
Yt = .07 FT
time t = 1.8 sec
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-04 = 5.966512E-03 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-04 = .1818593 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 09-MW-04 = 3856.505 GPD/FT^2


MW — 1
Site 10 — 165th Bulk Chemical Storage Area
A= 1.95
B= .24
D= 100 FT
H= 5.64 FT
calculated ln (Re/Rw) = 1.511035
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 5.64 FT
Y-intercept = .18 FT
Yt = .13 FT
time t = 30 sec
****
HYDRAULIC CONDUCTIVITY AT WELL 10-MW-01 = 8.230872E-05 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 10-MW-01 = 2.50877E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 10-MW-01 = 53.20093 GPD/FT^2
****
Change in Water Level (feet)
1.00
0.80
0.60
0.40
0.20
0.00
0.00
0.50
1.00
1.50
2.00
Time (minutes)


MW – 1
Site 11 – Old Burn Area
2.00
1.50
1.00
0.50
0.00
Change in Water Level (feet)
0.00
0.50
1.00
1.50
2.00
Time (minutes)
A= 2.05
B= .24
D= 100 FT
H= 7.12 FT
calculated ln (Re/Rw) = 1.715439
well casing radius Rc = .238 FT
radial dist. between well center and undisturbed zone Rw = .416 FT
screen or open-hole length = 7.12 FT
Y-intercept = .17 FT
Yt = .12 FT
time t = 30 sec
****
HYDRAULIC CONDUCTIVITY AT WELL 11-MW-01 = 7.922458E-05 FT/SEC
HYDRAULIC CONDUCTIVITY AT WELL 11-MW-01 = 2.414765E-03 CM/SEC
HYDRAULIC CONDUCTIVITY AT WELL 11-MW-01 = 51.20747 GPD/FT^2
****

SLUG TEST FIELD DATA FROM DATA LOGGER

01-MW-01
SE1000B
Environmental Logger
10/01 12:54

Unit# 00490 Test# 3

INPUT 1: Level (F)

Reference 0.00
Scale factor 29.92
Offset 0.00

Step# 1 10/01 11:44

Elapsed Time	Value
0.0000	- 0.11
0.0033	- 0.55
0.0066	- 5.03
0.0099	- 6.68
0.0133	- 4.66
0.0166	- 0.13
0.0200	- 1.18
0.0233	- 1.87
0.0266	- 1.48
0.0300	- 1.33
0.0333	- 1.35
0.0500	- 1.11
0.0666	- 0.96
0.0833	- 0.83
0.1000	- 0.73
0.1166	- 0.64
0.1333	- 0.56
0.1500	- 0.50
0.1666	- 0.45
0.1833	- 0.41
0.2000	- 0.37
0.2166	- 0.34
0.2333	- 0.32
0.2500	- 0.30
0.2666	- 0.28
0.2833	- 0.26
0.3000	- 0.25
0.3166	- 0.23
0.3333	- 0.22
0.4167	- 0.17
0.5000	- 0.15
0.5833	- 0.12
0.6667	- 0.11
0.7500	- 0.09
0.8333	- 0.08
0.9167	- 0.07
1.0000	- 0.06
1.0833	- 0.05
1.1667	- 0.05
1.2500	- 0.03
1.3333	- 0.03
1.4166	- 0.03
1.5000	- 0.02
1.5833	- 0.02
1.6667	- 0.01
1.7500	- 0.01
1.8333	- 0.00

02-MW-01
SE1000B
Environmental Logger
10/01 12:48

Unit# 00490 Test# 1

INPUT 1: Level (F)

Reference 0.00
Scale factor 29.92
Offset 0.00

Step# 1 10/01 10:15

Elapsed Time	Value
0.0000	- 3.82
0.0033	- 3.79
0.0066	- 2.37
0.0099	- 0.60
0.0133	- 1.55
0.0166	- 1.11
0.0200	- 1.05
0.0233	- 1.01
0.0266	- 0.90
0.0300	- 0.84
0.0333	- 0.78
0.0500	- 0.53
0.0666	- 0.38
0.0833	- 0.30
0.1000	- 0.26
0.1166	- 0.24
0.1333	- 0.22
0.1500	- 0.21
0.1666	- 0.20
0.1833	- 0.19
0.2000	- 0.19
0.2166	- 0.18
0.2333	- 0.18
0.2500	- 0.17
0.2666	- 0.17
0.2833	- 0.17
0.3000	- 0.16
0.3166	- 0.16
0.3333	- 0.16
0.4167	- 0.16
0.5000	- 0.15
0.5833	- 0.14
0.6667	- 0.13
0.7500	- 0.13
0.8333	- 0.12
0.9167	- 0.12
1.0000	- 0.11
1.0833	- 0.11
1.1667	- 0.11
1.2500	- 0.10
1.3333	- 0.10
1.4166	- 0.09
1.5000	- 0.09
1.5833	- 0.09
1.6667	- 0.09
1.7500	- 0.09
1.8333	- 0.08
1.9167	- 0.08
2.0000	- 0.08
2.5000	- 0.06
3.0000	- 0.06
3.5000	- 0.05
4.0000	- 0.04
4.5000	- 0.03
5.0000	- 0.03
5.5000	- 0.02
6.0000	- 0.02
6.5000	- 0.02
7.0000	- 0.01
7.5000	- 0.01
8.0000	- 0.01
8.5000	- 0.01
9.0000	- 0.00

05-MW-02
SE1000B
Environmental Logger
10/01 09:39

Unit# 00490 Test# 0

INPUT 1: Level (F)

Reference 0.00
Scale factor 29.92
Offset 0.00

Step# 1 10/01 09:20

Elapsed Time	Value
0.0000	- 2.03
0.0033	- 0.27
0.0066	- 1.05
0.0099	- 0.40
0.0133	- 0.32
0.0166	- 0.22
0.0200	- 0.16
0.0233	- 0.13
0.0266	- 0.12
0.0300	- 0.11
0.0333	- 0.10
0.0500	- 0.08
0.0666	- 0.07
0.0833	- 0.07
0.1000	- 0.06
0.1166	- 0.06
0.1333	- 0.06
0.1500	- 0.06
0.1666	- 0.06
0.1833	- 0.06
0.2000	- 0.05
0.2166	- 0.05
0.2333	- 0.05
0.2500	- 0.05
0.2666	- 0.05
0.2833	- 0.05
0.3000	- 0.05
0.3166	- 0.05
0.3333	- 0.05
0.4167	- 0.05
0.5000	- 0.05
0.5833	- 0.04
0.6667	- 0.04
0.7500	- 0.04
0.8333	- 0.04
0.9167	- 0.04
1.0000	- 0.04
1.0833	- 0.04
1.1667	- 0.04
1.2500	- 0.04
1.3333	- 0.04
1.4166	- 0.04
1.5000	- 0.04
1.5833	- 0.04
1.6667	- 0.04
1.7500	- 0.03
1.8333	- 0.03
1.9167	- 0.03
2.0000	- 0.03
2.5000	- 0.03
3.0000	- 0.03
3.5000	- 0.02
4.0000	- 0.02
4.5000	- 0.02
5.0000	- 0.02
5.5000	- 0.01
6.0000	- 0.01
6.5000	- 0.01
7.0000	- 0.01
7.5000	- 0.01
8.0000	- 0.01
8.5000	- 0.01
9.0000	- 0.01
9.5000	- 0.00

06-MW-01
SE1000B
Environmental Logger
10/01 18:27

Unit# 00490 Test# 8

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 17:05

Elapsed Time	Value
0.0000	- 0.29
0.0033	- 0.28
0.0066	- 0.29
0.0099	- 0.23
0.0133	- 0.23
0.0166	- 0.21
0.0200	- 0.20
0.0233	- 0.19
0.0266	- 0.17
0.0300	- 0.18
0.0333	- 0.16
0.0500	- 0.12
0.0666	- 0.08
0.0833	- 0.05
0.1000	- 0.02
0.1166	- 0.00

07-MW-01
SE1000B
Environmental Logger
10/01 12:57

Unit# 00490 Test# 4

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 12:19

Elapsed Time	Value
0.0000	- 0.05
0.0033	- 4.97
0.0066	- 5.71
0.0099	- 3.95
0.0133	- 2.20
0.0166	- 0.58
0.0200	- 0.33
0.0233	- 0.34
0.0266	- 0.33
0.0300	- 0.30
0.0333	- 0.25
0.0500	- 0.15
0.0666	- 0.12
0.0833	- 0.10
0.1000	- 0.09
0.1166	- 0.09
0.1333	- 0.08
0.1500	- 0.08
0.1666	- 0.07
0.1833	- 0.07
0.2000	- 0.07
0.2166	- 0.06
0.2333	- 0.06
0.2500	- 0.05
0.2666	- 0.05
0.2833	- 0.05
0.3000	- 0.05
0.3166	- 0.05
0.3333	- 0.04
0.4167	- 0.03
0.5000	- 0.03
0.5833	- 0.02
0.6667	- 0.02
0.7500	- 0.02
0.8333	- 0.01
0.9167	- 0.01
1.0000	- 0.01

08-MW-03
SE1000B
Environmental Logger
10/01 18:24

Unit# 00490 Test# 7

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 15:45

Elapsed Time	Value
0.0000	- 6.04
0.0033	- 5.15
0.0066	0.33
0.0099	- 1.21
0.0133	- 0.70
0.0166	- 0.61
0.0200	- 0.47
0.0233	- 0.36
0.0266	- 0.31
0.0300	- 0.26
0.0333	- 0.23
0.0500	- 0.17
0.0666	- 0.15
0.0833	- 0.14
0.1000	- 0.13
0.1166	- 0.12
0.1333	- 0.12
0.1500	- 0.12
0.1666	- 0.11
0.1833	- 0.11
0.2000	- 0.11
0.2166	- 0.11
0.2333	- 0.10
0.2500	- 0.10
0.2666	- 0.10
0.2833	- 0.10
0.3000	- 0.10
0.3166	- 0.10
0.3333	- 0.10
0.4167	- 0.09
0.5000	- 0.09
0.5833	- 0.09
0.6667	- 0.09
0.7500	- 0.08
0.8333	- 0.08
0.9167	- 0.08
1.0000	- 0.07

09-MW-03
SE1000B
Environmental Logger
10/01 18:30

Unit# 00490 Test# 9

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 17:51

Elapsed Time	Value
0.0000	- 3.63
0.0033	- 5.90
0.0066	- 0.37
0.0099	- 1.36
0.0133	- 0.93
0.0166	- 0.78
0.0200	- 0.64
0.0233	- 0.51
0.0266	- 0.43
0.0300	- 0.34
0.0333	- 0.29
0.0500	- 0.14
0.0666	- 0.10
0.0833	- 0.08
0.1000	- 0.07
0.1166	- 0.06
0.1333	- 0.06
0.1500	- 0.05
0.1666	- 0.05
0.1833	- 0.04
0.2000	- 0.05
0.2166	- 0.04
0.2333	- 0.04
0.2500	- 0.04
0.2666	- 0.04
0.2833	- 0.04
0.3000	- 0.04
0.3166	- 0.03
0.3333	- 0.04
0.4167	- 0.03
0.5000	- 0.02
0.5833	- 0.02
0.6667	- 0.02
0.7500	- 0.02
0.8333	- 0.02
0.9167	- 0.01
1.0000	- 0.01

09-MW-04
SE1000B
Environmental Logger
10/01 12:51

Unit# 00490 Test# 2

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 10:59

Elapsed Time	Value
0.0000	- 8.59
0.0033	- 2.64
0.0066	- 0.97
0.0099	- 0.57
0.0133	- 0.41
0.0166	- 0.33
0.0200	- 0.19
0.0233	- 0.12
0.0266	- 0.07
0.0300	- 0.05
0.0333	- 0.03
0.0500	0.00

10-MW-01
SE1000B
Environmental Logger
10/01 18:21

Unit# 00490 Test# 6

INPUT 1: Level (F)

Reference 0.00
Scale factor 29.92
Offset 0.00

Step# 1 10/01 15:10

Elapsed Time	Value
0.0000	- 4.31
0.0033	- 2.89
0.0066	- 0.98
0.0099	- 0.90
0.0133	- 0.93
0.0166	- 0.83
0.0200	- 0.73
0.0233	- 0.69
0.0266	- 0.66
0.0300	- 0.60
0.0333	- 0.56
0.0500	- 0.37
0.0666	- 0.27
0.0833	- 0.21
0.1000	- 0.19
0.1166	- 0.17
0.1333	- 0.17
0.1500	- 0.16
0.1666	- 0.16
0.1833	- 0.16
0.2000	- 0.15
0.2166	- 0.15
0.2333	- 0.15
0.2500	- 0.14
0.2666	- 0.14
0.2833	- 0.14
0.3000	- 0.14
0.3166	- 0.14
0.3333	- 0.13
0.4167	- 0.12
0.5000	- 0.12
0.5833	- 0.11
0.6667	- 0.10
0.7500	- 0.08
0.8333	- 0.08
0.9167	- 0.07
1.0000	- 0.06
1.0833	- 0.05
1.1667	- 0.05
1.2500	- 0.04
1.3333	- 0.04
1.4166	- 0.03
1.5000	- 0.03
1.5833	- 0.03
1.6667	- 0.02
1.7500	- 0.02
1.8333	- 0.01
1.9167	- 0.01
2.0000	- 0.01
2.5000	0.00

11-MW-01
SE1000B
Environmental Logger
10/01 18:18

Unit# 00490 Test# 5

INPUT 1: Level (F)

Reference	0.00
Scale factor	29.92
Offset	0.00

Step# 1 10/01 14:19

Elapsed Time	Value
0.0000	- 8.31
0.0033	- 6.87
0.0066	- 0.81
0.0099	- 1.80
0.0133	- 1.45
0.0166	- 1.49
0.0200	- 1.46
0.0233	- 1.49
0.0266	- 1.37
0.0300	- 1.33
0.0333	- 1.28
0.0500	- 1.12
0.0666	- 0.98
0.0833	- 0.84
0.1000	- 0.73
0.1166	- 0.63
0.1333	- 0.53
0.1500	- 0.46
0.1666	- 0.37
0.1833	- 0.32
0.2000	- 0.28
0.2166	- 0.24
0.2333	- 0.22
0.2500	- 0.20
0.2666	- 0.18
0.2833	- 0.18
0.3000	- 0.16
0.3166	- 0.16
0.3333	- 0.16
0.4167	- 0.12
0.5000	- 0.11
0.5833	- 0.10
0.6667	- 0.09
0.7500	- 0.08
0.8333	- 0.07
0.9167	- 0.06
1.0000	- 0.06
1.0833	- 0.06
1.1667	- 0.05
1.2500	- 0.04
1.3333	- 0.05
1.4166	- 0.05
1.5000	- 0.04
1.5833	- 0.04
1.6667	- 0.04
1.7500	- 0.04
1.8333	- 0.04
1.9167	- 0.03
2.0000	- 0.03
2.5000	- 0.01
3.0000	- 0.00

CCJM

ENVIRONMENTAL ENGINEERS & SCIENTISTS

SILVER SPRING
CHICAGO
DENVER
GRAND RAPIDS

MEMORANDUM

TO: Richard Olson, CH2M Hill/Deerfield Beach, FL

FROM: Jeralyn Guthrie, Richard Cheatham, CCJM/Denver

DATE: February 22, 1991

DOCUMENT NO: GATRS012.MEM

SUBJECT: Georgia Air National Guard Data Validation Reports - HAZWRAP Level C

Enclosed are the HAZWRAP - Level C data validation reports and the attached copies of data results forms (Form I's) which have data reviewer qualifiers added. One data review report is provided for the following types of analyses:

13 data packages for: Volatile Analysis (8010/8020, 601/602)

If you have any questions concerning this submittal, please call (303) 987-2928.

cc: GANG - PF

C.C. JOHNSON & MALHOTRA, P.C.
215 UNION BOULEVARD, SUITE 215 • LAKEWOOD, COLORADO 80228 • (303) 987-2928

CCJM
ENVIRONMENTAL ENGINEERS & SCIENTISTS

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DOCUMENT NO.: GAODS006.RVW

ORGANICS DATA REVIEW SUMMARY - LEVEL C

Case No. N/A Project No. 27794.CO.02

Site Georgia Air National Guard

Contract Laboratory CH2M Hill - Redding and Gainesville*

Sample Delivery Group (SDG) N/A Sampling Date (Month/Year) 5/90, 6/90 & 9/90

Sample Matrix low level soils and waters

Type of Analyses/Special Request volatile analysis (8010/8020, 601/602)

Data Package #				
	16057	16899	16280*	16853
	16065	16873	16281*	(see next page for
	16272*	16828	16834	samples associated
	16864	16882	16913	with each data package)

Data Reviewer Linda L. Morrison *lm* Date 2/22/91

QA Review by Jeralyn Guthrie *JG* Date 2/22/91

CCJM Approval by Richard Cheatham *for* Date 2/22/91

Telephone logs/correspondence attached? Yes X No ____

Laboratory case narrative attached? Yes X No ____

Required deliverables provided? Yes X No ____ Not Appl. ____

Note:

— The Level C Data Validation Guidelines as specified in HAZWRAP Requirements for Quality Control of Analytical Data, Section 8.3.2 (Document No. DOE/HWP-65/R1, Revision July, 1990) have been used by the data reviewer as a basis for reviewing the data and applying flags, except as specifically noted in review comments.

— Please see data flagging definitions on the last page of this report.

To facilitate the review of this report, we are providing the following listing of samples associated with the respective SDG No.s.

16057 (26625)

06-HA-02
06-HA-08
06-HA-09
06-HA-17
06-HA-BD
Trip Blank 5/22

16065 (26658)

05-HA-03
05-HA-08
Rinsate 5/25
Decon water 5/25
Trip Blank 5/25

16272

05-SB-05-0-2
05-SB-05-6-8
02-SB-01-0-2
02-SB-01-6-8
09-SB-01-0-2
09-SB-01-6-8
09-SB-02-0-2
09-SB-02-4-6
09-SB-02-6-8
09-SB-03-0-2
09-SB-03-4-6
09-SB-03-6-8
09-SB-05-0-2
09-SB-05-6-8
09-SB-D2
05-SB-01-4-6
05-SB-01-7-8
05-SB-03-1-3
05-SB-03-9-11
05-SB-04-0-2
05-SB-04-8-10
05-SB-D1
Trip Blank 6/27

16864 (27629)

09-MW-02
09-MW-03
09-MW-04
09-MW-05
09-MW-D3
Field Blank 9/20
Trip Blank 9/20

16873 (27642)

08-SS-01
08-SS-02
08-SS-03
08-SS-04
08-SS-05
08-SS-06
08-SS-D1
Rinsate Blank 9/21
Trip Blank 9/21

16882 (27654)

09-SS-01
07-SS-01
07-SS-02
07-SS-03
07-SS-04
09-SS-D2
Trip Blank 9/24

16280

07-SB-02-0-2
07-SB-02-4-6
01-SB-01-0-2
01-SB-01-12-14
11-SB-01-0-2
11-SB-01-2-4
11-SB-01-8-10
11-SB-02-0-2
11-SB-02-10-12
11-SB-D3

16899 VOA only

09-SW-01
09-SW-02
07-SW-01
07-SW-02
07-SW-03
09-SW-D1
07-SW-D2
01-SW-01
01-SW-02
01-SW-03
01-SW-04
01-SS-01
01-SS-02
01-SS-03
01-SS-04
01-SS-05
01-SS-06
01-SS-07
01-SS-08
01-SS-09
01-SS-10
01-SS-11
01-SS-12
01-SS-D3
Rinsate Blank 9/25
Trip Blank 9/25

16281

10-SB-01-0-2
10-SB-01-10-11
08-SB-01-0-2
08-SB-01-8-10
08-SB-02-0-2
08-SB-02-2-4
08-SB-02-8-10
08-SB-D4
08-SB-03-0-2
08-SB-03-4-6
Rinsate Blank 6/29
Trip Blank 6/29

<u># 16828</u> (27598)

08-SW-01
08-SW-02
08-SW-03
08-SW-04
01-MW-02
05-MW-01
05-MW-02
05-MW-03
05-MW-04
Rinsate blank (9/14)
Trip Blank (9/14)

<u># 16834</u> (27591)

05-EW-108
01-MW-01
02-MW-01
06-MW-01
07-MW-01
08-MW-01
08-MW-02
08-MW-03
08-MW-04
Trip Blank 9/15
Rinsate Blank 9/17
08-MW-D1

<u># 16853</u> (27615)

11-MW-01
11-MW-02
11-MW-03
11-EW-B3
10-MW-01
02-SW-01
02-SW-02
11-MW-D2
Trip Blank 9/18
Rinsate Blank 9/18
02-SS-01
02-SS-02
02-SS-03
02-SS-04

<u># 16913</u> (27678)

09-MW-01
Trip Blank 9/26

I. <u>Holding Times</u>

Samples were extracted and analyzed within holding times specified by the HAZWRAP data validation guidelines.

Yes __X__ No _____

Comments: No comment.

II. The percent relative standard deviation (%RSD) for the initial calibrations and the percent difference (%D) for the continuing calibrations were reviewed. The %RSD and %D values reported met the data validation criteria for volatile analyses.

Yes _____ No __X__

Comments:

1. The 20% RSD control limit specified for data validation purposes was exceed for the following data packages:

Package No.	Compounds	RSD
16899 (soils), 16873, 16828, 16882, 16834, 16913 and 16853	1,2-dichlorobenzene	20.5%
	1,3-dichlorobenzene	28.5%
	1,4-dichlorobenzene	24%
16899 (waters)	bromoform	23%
	ethylbenzene	26%
	xylene	23%
	benzene	22%
	toluene	22%

Level C validation guidelines specify that quantitative (i.e., positive) results are to be qualified as estimated (J). However, no positive results for these compounds were reported and no qualifiers were applied as a result of the control limit being exceeded.

2. Continuing calibration was performed, however, the frequency requirement of analyzing a mid-level standard every 5 samples was not met for the following packages: 16272 (7/2 and 7/3), 16828 (6/24) and 16281 (7/9). No qualifiers have been applied based solely on non-compliancy related to frequency.

3. The Redding laboratory did report all initial analyses with relative response factors and %RSD. However, with the continuing calibration all results were reported in PPB's with laboratory PPB range limits. HAZWRAP guidelines specifically require the data reviewer to examine %D values. The laboratory was contacted, and has resubmitted all continuing calibration data with %D values included.

4. The following table lists the calibration dates and compounds found to have %D values outside of data validation guideline specifications. The %D value is shown in parentheses and the data packages affected are also listed. All positive results with a %D greater than 15% are qualified as estimated (J). The validation guidelines do not provide specifications for qualifying the non-detected results, but in the reviewer's judgement a number of the percent differences greatly exceeded the criteria and thus in those situations where the %D exceeds approximately 30% the non-detects have been qualified as estimated (UJ). The compounds preceded by a "+" have only the positive results qualified.

5. The Gainesville laboratory has provided the confirmation analysis if needed on the following page of the Form 1's.

6. In some cases the %D's for continuing calibrations were provided for the same day. It could not be determined which calibration was associated with a specific column analysis and therefore when the % D was exceeded for either column the results have been qualified.

Date of Continuing Calibration	Compound/% Difference	Associated Data Package
5/30	tert-butyl methyl ether (474), xylene (42.9)	16057
6/7	tert-butyl methyl ether (485.8)	16065
7/2	no limits exceeded	16272
7/3	no limits exceeded	16272
7/4	chloroethane (41)	16272
7/5	chloromethane (47), vinyl chloride (38.6)	16280, 16272
7/7	tert-butyl methyl ether (120)	16280
7/8	vinyl chloride (33), tert-butyl methyl ether (67), +1,2-dichlorobenzene (21)	16280, 16281

Date of Continuing Calibration	Compound/% Exceeded Limits	Associated Data Package
7/9	vinyl chloride (32), tert-butyl methyl ether (52), 1,2-dichlorobenzene (21)	16281
7/11	chloroethane (35.6), tert-butyl (120), +dichloromethane (21.7)	16272, 16280 16281
7/10	tert-butyl methyl ether (87), +trichlorofluoromethane (16.6), +dichloromethane (18)	16272, 16280 16281
7/12	+toluene(23)	16280, 16281
7/13	no limits exceeded	16281
9/23	no limits exceeded	16828
9/24	tert-butyl methyl ether (76.2) +methylene chloride (17.6)	16828
9/25	tert-butyl (55.7), +methylene chloride (15.5)	16834
9/26	tert-butyl (58.6), +methylene chloride (18.8)	16834
9/28	tert-butyl (75.8), +benzene (18.9), +toluene (17.4), +methylene chloride (19.6)	16853
9/29	tert-butyl (83.4), +1,1-dichloroethane (23.4), +1,1,1-trichloroethene (20.5), +benzene (28.2), +toluene (26.2), +xylene (19.3), +ethylbenzene (17.2)	16834, 16853
10/2	tert-butyl (73.9), benzene (17.6)	16853, 16864
10/1	chloromethane (143.7), tert-butyl (81.9), +benzene (22), +toluene (19.8)	16853, 16864
10/3	tert-butyl (81.1), +benzene (17.3), +toluene (16), +methylene chloride (16.3)	16864
10/4	chloromethane (71.1), vinylchloride (75.7), tert-butyl (79.1), +cis 1,3-dichloropropene (29.3), +1,1-dichloroethane (24.5), +1,1,1-trichloroethane (21), +benzene (18.9), +toluene (18.5), +methylene chloride (18.4)	16864, 16873 16899

Date of Continuing Calibration	Compound/% Exceeded Limits	Associated Data Package
10/5	chloroethane (35), tert-butyl (61.4)	16873, 16899
10/6	tert-butyl (86.4), +methylene chloride (27.4)	16899
10/7	tert-butyl (58.7)	16882, 16899
10/8	tert-butyl (80.5)	16882, 16899 16913

III. Blanks

A. Method Blank - The blank analyses summaries were reviewed. The frequency of method blank extractions and analysis and the contaminants reported in blank samples were all within specified limits.

Yes __X__ No _____

Comments: No comment.

B. Trip Blank - The associated trip/travel blank(s) contained contaminants which affected samples in the packages.

Yes __X__ No _____ Not Identified _____

1. The following table lists the trip blanks, contaminants, quantities and associated samples which are qualified (UJ) due to contamination potentially having occurred during handling and/or storage.

2. In some cases, contaminants are only found on one column but not both. In these instances only sample results analyzed on the associated column are qualified. Only primary column results are reported.

Data Package No.	Blank ID	Analyte	Amount (ug/L)
16057	TB (5/22)	Dichloroethane*	1.0
16065	TB (5/25)	Dichloromethane+	3.0

* Primary column only
\+ Both columns

Data Package No.	Blank ID	Analyte	Amount (ug/L)
16272	TB (6/27)	Trichlorofluoromethane+	5.5
		Dichloromethane+	1.5
16280	none associated with this data package		
16281	TB (6/29)	Dichloromethane+	1.7
16828	TB (9/14)	Dichloromethane+	3.1
16834	TB (9/15)	Dichloromethane+	3.3
16853	TB (9/18)	Dichloromethane+	3.7
16864	TB (9/20)	Dichloromethane+	2.9
16873	TB (9/21)	Dichloromethane+	2.3
16882	TB (9/24)	None found	
16899	TB (9/25)	None found	
16913	TB (9/26)	None found	

* Primary column only
\+ Both columns

C. Other Blanks - The following are other blanks found in the data packages and the compound quantities reported, however no sample data has been qualified by the reviewer based on the results of these blanks. Only primary column results are reported.

Data Package No.	Blank ID	Analyte	Amount (ug/L)
16065	Rinsate (5/25)	Dichloromethane+	17
	Decon Blank (5/25)	Dichloromethane+	3
16281	Rinsate Blank (6/29)	Trichlorofluoromethane+	0.52
		Dichloromethane+	2.0
16828	Rinsate Blank (9/14)	Dichloromethane+	130
16834	Rinsate Blank (9/17)	Dichloromethane+	2.8
16853	Rinsate Blank (9/19)	Dichloromethane+	4.3

Data Package No.	Blank ID	Analyte	Amount (ug/L)
16864	Rinsate Blank (9/20)	None found	
16873	Rinsate Blank (9/21)	None found	
16899	Rinsate Blank (9/25)	Dichloromethane+	18

* Primary column only
\+ Both columns

IV. Surrogate Recovery

The surrogate recovery summaries were reviewed. The recoveries were all reported to be within specified QC criteria.

Yes _____ No __X__

Comments:

1. Samples reported to have surrogate recoveries outside specified criteria are summarized on the attached Tables 1 and 2. Data flags, when necessary, are also indicated.

2. Two packages 16057 and 16065 has one soil surrogate with no established limits considered to be applicable. The other soil surrogates for these data packages were within established control limits. The laboratory was contacted and stated there were no control limits established when the samples were analyzed. No action has been taken by the reviewer.

3. The Gainesville Laboratory did not initially provide surrogate summary charts or control limits. The laboratory was contacted and resubmitted the control charts and all surrogate recoveries were found to be acceptable. The following packages were analyzed by Gainesville with the following range of limits being applicable: 16272 (83-125%), 16280 (91-120%) and 16281 (95-115%).

4. The following samples have one surrogate in and one surrogate outside of provided control limits. For package 16882, sample number 09-SS-D2 (51%R) and for package 16853, and sample number 11-MW-D2 (41%R) have been qualified as estimated (J or UJ).

5. For package 16864 the samples were diluted and diluted results were within provided control limits. Although for the initial analysis of this package a number of samples were found to have recoveries outside limits, no results have been qualified since the diluted results were found to be within limits.

V. Blank Spike Control Sample(s)

A. Blank spike analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within CLP MS/MSD control limits.

Yes __X__ No _____

B. Laboratory control charts were provided in the package and the limits specified by the control charts were used for review.

Yes __X__ No _____

Comments: No comment.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The matrix spike and matrix spike duplicate recovery summary data were reviewed. The spiking procedures were performed and met all recommended QC specifications.

Yes __X__ No _____

Comments: All target compounds were included for spiking and below is a table summarizing the associated spiked samples for each data package. As shown the over-all frequency requirement for spikes of 1 per 20 samples was met. No data has been qualified based solely on spike recovery results.

Data Package	No. of samples/matrix	Sample used for spike	Comments
16057	5 soils/1 water	06-HA-BD/TB 5/22	*
16065	2 soils/3 waters	06-HA-BD/TB 5/22	*

Data Package	No. of samples/matrix	Sample used for spike	Comments
16272	22 soils/1 water	05-SB-05-6-8/09-SB-02-6-8	*
16864	7 waters	09-MW-05	*
16899	13 waters	07-SW-02/01-SS-05	*
16873	7 soils/2 waters	08-SS-03	+
16828	4 soils/7 waters	05-MW-02	+
16882	6 soils/1 water	07-SS-02	+
16280	10 soils	None provided	
16281	10 soils/2 waters	08-SB-01-0-2	*
16834	12 waters	07-MW-01	+
16913	2 waters	Associated w/package 16899	*
16853	10 waters/4 soils	02-SW-01/02-SS-04	+

Total soils = 70, 8 soil samples spiked, 1 in 9 frequency

Total waters = 61, 6 soil samples spiked, 1 in 10 frequency

* Method spike control limits were used.
+ No method or spike control limits were provided

VII. Additional Comments

1. The same samples were reported for volatile analysis in both packages 16899 and 16912 (i.e., a duplicate set of data was found). This validation report shows these samples as being in package 16899.

2. The compound, 2-chloroethyl vinyl ether is listed on Table B-3 in the GANG QAPP, and is a target analyte shown in both methods 601 and 8010, but was not reported for any of the packages.

3. Trichloroethane and Bromodichloromethane are reported together for packages 16272, 16280 and 16281 (Gainesville Lab). Apparently these compounds could not be separated. The laboratory was contacted and replied that on the DB-1 column the compounds do not separate but on the secondary column, DB-624 the compounds are separated.

4. Sample 05-SB-04-0-2 for the confirmation analysis, a laboratory signature was not found on the results form.

VIII. Deliverables

All data deliverables as specified for HAZWRAP Level C quality control were found in the package.

Yes __X__ No _____

Comments: See the attached Level C Data Deliverable Checklist for a listing of the Forms and data found in the package.

LEVEL C DELIVERABLES COMPLETENESS CHECKLIST - ORGANICS

KEY

__X__ Included in package
__O__ Not included and/or Not available
__NA__ Not applicable or Not required
__R__ Provided as resubmission

__X__ Case Narrative
__X__ Method blank spikes with each batch
    __R/O__ Control chart developed by lab
__X__ Sample results - Form 1 or spreadsheet
    __X__ Sample chromatograms and mass spectra
    __O__ CLP data flags used by laboratory
__X__ Holding times (prep and analysis dates provided)
__X__ Surrogate recoveries - Form 2 or equivalent
__X__ Matrix spike/matrix spike duplicate (MS/MSD) - Form 3 MS/MSD is to be 1 per 20 samples of similar matrix)
__X__ Method blank summary - Form 4 or equivalent
    __X__ Report form for method blank results (Form 1 or spreadsheet)
__NA__ GC/MS tuning - Form 5 or equivalent
__X__ Initial calibration data, Form 6 or equivalent
__NA__ Pesticide/PCB calibration standards summary - Form 8D
__R__ Continuing calibration data, Form 7 or equivalent
__NA__ Internal standard area summary, Form 8A, 8B, or 8C
__NA__ Pesticide/PCB continuing calibration data - Form 9
    __NA__ Pesticide/PCB 2nd column confirmation - chromatograms

EXPLANATION OF ORGANICS DATA FLAGS

For the purposes of this data review document the following code letters and associated definitions are provided:

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.

R - Quality Control indicates that data is not usable (i.e. compound may or may not be present). Resampling and re-analysis would be necessary to determine the presence or absence of the analyte in the sample.

J - The associated numerical value is an estimated quantity because quality control criteria were not met or because the amount detected is below the detection limits required by analytical Statement of Work. The laboratory uses this flag in the latter situation.

B - The laboratory uses this flag when the reported analyte was also found in the method blank. Data validation guidelines do not specify the use of this flag.

JN - Tentative identification of a compound at an estimated concentration. Resampling and re-analysis would be necessary for verification.

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DOCUMENT NO.: GAODS007.RVW

ORGANICS DATA REVIEW SUMMARY - HAZWRAP LEVEL C

Case No. N/A Project No. 27794.00.02

Site Georgia Air National Guard

Contract Laboratory CH2M Hill - Montgomery

Sample Delivery Group (SDG) N/A Sampling Date (Month/Year) 5/90, 6/90 & 9/90

Sample Matrix low level waters and low level soils

Type of Analyses/Special Request Polynuclear Aromatic Hydrocarbons

Data Package #

16057	16899	16280	16853	
16065	16873	16281	16912	
16272	16828	16834		
16864	16882	16913		

Data Reviewer Linda L. Morrison llm Date 2/19/91

QA Review by Jeralyn Guthrie JG Date 2/19/91

CCJM Approval by Richard Cheatham Rec Date 2/19/91

Telephone logs/correspondence attached? Yes X No ____

Laboratory case narrative attached? Yes X No ____

Required deliverables provided? Yes X No ____ Not Applicable ____

Note:
— The Level C Data Validation Guidelines as specified in HAZWRAP Requirements for Quality Control of Analytical Data, Section 8.3.2 (Document No. DOE/HWP-651-R1, Revision 1, July 1990) have been used by the data reviewer as a basis for reviewing the data and applying flags, except as specifically noted in review comments.

— Please see data flagging definitions on the last page of this report.

To facilitate the review of this report, we are providing the following listing of samples associated with the respective SDG/Package Numbers.

16057

06-HA-02
06-HA-08
06-HA-09
06-HA-17
06-HA-BD

16065

05-HA-03
05-HA-08
Field Rinsate 5/25
Decon water 5/25

16272

05-SB-05-0-2
05-SB-05-6-8
02-SB-01-0-2
02-SB-01-6-8
09-SB-01-0-2
09-SB-01-6-8
09-SB-02-0-2
09-SB-02-4-6
09-SB-03-0-2
09-SB-03-4-6
09-SB-05-0-2
09-SB-05-6-8
09-SB-D2
05-SB-01-4-6
05-SB-01-7-8
05-SB-03-1-3
05-SB-03-9-11
05-SB-04-0-2
05-SB-04-8-10
05-SB-D1

16828

08-SW-01
08-SW-02
08-SW-03
08-SW-04
01-MW-02
05-MW-01
05-MW-02
05-MW-03
05-MW-04
Field Blank 9/14

16834

05-EW-108
01-MW-01
02-MW-01
06-MW-01
07-MW-01
08-MW-01
08-MW-02
08-MW-03
08-MW-04
Field Blank 9/17
08-MW-D1

16913

09-MW-01

16280

07-SB-02-0-2
07-SB-02-4-6
01-SB-01-0-2
01-SB-01-12-14
11-SB-01-2-4
11-SB-01-8-10
11-SB-02-0-2
11-SB-02-10-12
11-SB-D3

16864

09-MW-02
09-MW-03
09 MW-04
09-MW-05
09-MW-D3
Field Blank 9/20

16899

09-SW-01
09-SW-02
07-SW-01
07-SW-02
07-SW-03
09-SW-D1
07-SW-D2
01-SW-01
01-SW-02
01-SW-03
01-SW-04
Field Blank 9/25

16873

08-SS-01
08-SS-02
08-SS-03
08-SS-04
08-SS-05
08-SS-06
08-SS-D1
Field Blank 9/21

16882

09-SS-01
07-SS-01
07-SS-02
07-SS-03
07-SS-04
09-SS-D2

# 16853	# 16912 PNA only	# 16281
11-MW-01	01-SS-01	10-SB-01-0-2
11-MW-02	01-SS-02	10-SB-01-10-11
11-MW-03	01-SS-03	08-SB-01-0-2
11-EW-B3	01-SS-04	08-SB-01-8-10
10-MW-01	01-SS-05	08-SB-02-0-2
02-SW-01	01-SS-06	08-SB-02-8-10
02-SW-02	01-SS-07	08-SB-D4
11-MW-D2	01-SS-08	08-SB-03-0-2
Field Blank 9/18	01-SS-09	08-SB-03-4-6
02-SS-01	01-SS-10	Field Blank 6/29
02-SS-02	01-SS-11	
02-SS-03	01-SS-12	
02-SS-04	01-SS-D3	

I. Holding Times

Samples were extracted and analyzed within holding times specified by the HAZWRAP data validation guidelines.

Yes _____ No __X__

Comments: An asterisk and number in parenthesis indicates a sample fraction outside holding time specifications and the number of days exceeded based on the date sampled. Data for any sample fraction with exceeded holding times are flagged as estimated (J or UJ).

Holding Time Summary

Data Package	Sample Number	Sampling Date	PNA Extract	PNA Analysis
16272	09-SB-02-0-2	6/27/90	7/09/90	7/11/90
	09-SB-03-4-6	6/27/90	7/09/90	7/11/90
	09-SB-02-0-2RE	6/27/90	7/12/90*(1)	7/13/90
	09-SB-03-4-6RE	6/27/90	7/12/90*(1)	7/13/90

Please note the original analysis was within the required holding times.

II. The percent relative standard deviation (%RSD) for the initial calibrations and the percent difference (%D) for the continuing calibrations were reviewed. The %RSD and %D values reported met the data validation criteria for the PNA analysis.

Yes _____ No __X__

Comments: The %RSD and/or %D values outside of the data validation guideline specifications are listed below. The following out-of-control calibrations have resulted in associated sample data being flagged as estimated (J or UJ). The affected samples are found in package 16899.

Compound	Continuing Calibration Date / %D
Acenaphthylene	10-7-91 / 16.3%

III. Blanks

A. Method Blank - The summaries for blank analyses were reviewed. The frequency of method blank extractions and analysis and the contaminants reported in blank samples were all within specified limits.

Yes __X__ No _____

Comments: No comment.

B. Other Blanks - The following are other blanks which were reported with the data packages, however, no contaminants were found in any of these samples.

Data Package No.	Blank ID
16065	Decon Blank (5/25) Rinsate (5/25)
16864	Field Blank (9/20)
16899	Field Blank (9/25)
16873	Field Blank (9/21)
16828	Field Blank (9/14)
16281	Field Blank (6/29)
16834	Field Blank (9/17)
16853	Field Blank (9/18)

IV. Surrogate Recovery

The surrogate recovery summaries were reviewed. The recoveries were all reported to be within specified QC criteria.

Yes _____ No __X__

Comments:

1. Samples reported to have surrogate recoveries outside laboratory specified criteria are reported below. Data flags, when necessary, have been added to results on Form 1's.

2. The laboratory did not report the specific limits that have been established for the surrogate recoveries, but for each sample it was indicated whether the surrogate recovery value was within control limits. This means of indicating those samples with a recovery outside control limits is the only source of such information available to the reviewer for determining the need for qualifiers.

3. Some of the method blanks for two data packages (16899 and 16913), according to the case narrative, were not spiked with surrogate compounds so the lack of surrogate recovery has not generated any data qualifiers.

Data Package No.	Sample Number	% Recovery	Qualifier
16272	09-SB-02-0-2	54	None
	09-SB-02-0-2RE	92	None
	09-SB-03-4-6	42	None
	09-SB-03-4-6RE	86	None
16873	Method blank	120	None
	08-SS-05	105	J
	08-SS-06	105	J
16912	01-SS-04	103	J
	01-SS-06	110	None
	01-SS-D3	104	None

NOTE: Samples 09-SB-02-0-2 and 09-SB-03-4-6 are not qualified since the reanalysis values are within specified limits and the sample results are the same for both analyses. For the other samples listed above, only the positive results have been qualified as estimated (J) since the surrogate recoveries are high.

V. Blank Spike/Laboratory Control Sample(s)

A. Blank Spike/Laboratory Control Sample (LCS) analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within CLP established control limits. (NOTE: The method blank, spiked with surrogates, can be used as the blank spike/LCS for volatiles and semi-volatiles).

Yes _____ No __X__

Comments:

1. As mentioned in the previous section concerning surrogate recoveries, packages 16899 and 16913 did not have method blank spike recovery results since the surrogate spikes were inadvertently omitted.

B. Laboratory control charts were provided in the package and the limits specified by the control charts were used for review.

Yes _____ No __X__

Comments:

1. Although control charts were not actually provided, the laboratory did provide information indicating when surrogate recoveries were outside their established limits. This information was provided for the blank analyses, as well.

2. For the following packages one method blank was within specified control limits, however, a second method blank was outside specified limits; Package 16065 (63%), Package 16912 (45%), 16280 (58%) and 16281 (59%). Since surrogate recoveries were found to be within the laboratory's control limits for all samples in these data packages the reviewer has not qualified any sample data based on these low blank spike recoveries.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The matrix spike and matrix spike duplicate recovery summary data were reviewed.

Yes __X__ No _____

Comments:

1. Three compounds were spiked for the MS/MSD analyses. No control limits established specifically for this method were provided.

2. The following table summarizes the spiked samples by package number and shows the number of samples and matrix types found in those packages. The range of matrix spike recoveries reported for each of the spiked samples is shown in the last column.

Data Package	Spiked Sample	# of samples/matrix	% Recovery
16057	06-HA-BD	5 soils	77 - 95
16065	06-HA-BD	2 soils/2 waters	77 - 95
16272	05-SB-05-6-8 09-SB-03-0-2	21 soils	84 - 89 81 - 87
16864	Associated with 16899	6 waters	89 - 99
16899	07SW02 / 01SS05	12 waters	89 - 99
16873	Associated with 16899	7 soils/1 water	*
16828	05MW02	10 waters	59 - 78
16882	Associated with 16912	6 soils	78 - 90
16912	01-SS-11	13 soils	78 - 90
16280	11-SB-01-2-4	10 soils	0% +
16281	08-SB-01-02	10 soils/1 water	87 - 90
16834	08-MW-D1	11 waters	67 - 77
16913	Associated with 16899	1 water	89 - 99
16853	02-SW-01	9 waters/4 soils	38 - 78

Total soils = 78, Number of spiked samples = 7 1 in 11 frequency

Total waters = 53, Number of spiked samples = 4 1 in 13 frequency

* No soil MS/MSD is reported in package 16899.

\+ The laboratory reported the 0% recovery due to "high chemical noise" and therefore did not re-analyze.

3. As shown by the above table the over-all frequency for the MS/MSD analysis meets the 1 per 20 samples of similar matrix requirement. For data package 16873, the laboratory shows it to be associated with package 16899 which contains all water samples. This does not suffice for the soils since a soil MS/MSD is not provided in that package, however since the over-all frequency requirements were met no data has been determined to be affected.

VII. Additional Comments

1. The case narrative stated that a single injection into a dual column/FID system was used. The HAZWRAP guidelines are specific as to requiring both primary and secondary confirmation column chromatograms and values and since only a "single chromatogram" was provided for each sample further inquiries were made as to the set-up of this analytical system. Attached are copies of the memo and the response from the laboratory explaining the process they used in obtaining results. The explanation provided and the copy of the chromatogram from a calibration standard indicates that this system using two columns connected to a single FID does provide for adequate separation of all target compound peaks.

2. The case narrative stated that in some cases the best (i.e., desired) detection limits could not be met due to interferences.

3. Some sample numbers have the notation "MS/MSD" attached to the sample number; this is only an indication of this being the associated spiked sample. These copies of the sample results forms have not been attached to this report.

VIII. Deliverables

All data deliverables as specified for HAZWRAP Level C quality control were found in the package.

Yes __X__ No _____

Comments: See the attached Level C Data Deliverables Checklist for a listing of the Forms and data found in the package.

LEVEL C DELIVERABLES COMPLETENESS CHECKLIST - ORGANICS

KEY

X	Included in package
O	Not included and/or Not available
NA	Not applicable or Not required
RS	Provided as resubmission

__X__ Case Narrative
__X__ Method blank spikes with each batch
  __O__ Control chart developed by lab
__X__ Sample results - Form 1 or spreadsheet
  __X__ Sample chromatograms and/or mass spectra
  __X__ CLP data flags used by laboratory (not specified HAZWRAP Table 5.1)
__X__ Holding times (sampling, prep and analysis dates provided)
__X__ Surrogate recoveries - Form 2 or equivalent
__X__ Matrix spike/matrix spike duplicate (MS/MSD) - Form 3 or equivalent (MS/MSD is to be 1 per 20 samples of similar matrix)
__X__ Method blank summary - Form 4 or equivalent
  __X__ Report form for method blank results (Form 1 or spreadsheet)
__NA__ GC/MS tuning - Form 5 or equivalent
__X__ Initial calibration data, GC/MS - Form 6 or equivalent
__NA__ Pesticide/PCB calibration standards summary - Form 8D
__X__ Continuing calibration data, GC/MS - Form 7 or equivalent
__X__ Internal standard area summary, GC/MS - Form 8A, 8B, or 8C
__NA__ Pesticide/PCB continuing calibration data - Form 9
  __NA__ Pesticide/PCB 2nd column confirmation - chromatograms

EXPLANATION OF ORGANICS DATA FLAGS

For the purposes of this data review document the following code letters and associated definitions are provided:

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.

R - Quality Control indicates that data is not usable (i.e. compound may or may not be present). Resampling and re-analysis would be necessary to determine the presence or absence of the analyte in the sample.

J - The associated numerical value is an estimated quantity because quality control criteria were not met or because the amount detected is below the detection limits required by the analytical Statement of Work. The laboratory uses this flag in the latter situation.

B - The laboratory uses this flag when the reported analyte was also found in the method blank. Data validation guidelines do not specify the use of this flag.

JN - Tentative identification of a compound at an estimated concentration. Resampling and re-analysis would be necessary for verification.

CCJM
ENVIRONMENTAL ENGINEERS & SCIENTISTS

SILVER SPRING
CHICAGO
DENVER
GRAND RAPIDS

MEMORANDUM

TO: Richard Olson, CH2M Hill/Deerfield Beach, FL

FROM: Jeralyn Guthrie, Richard Cheatham, CCJM/Denver

DATE: January 31, 1991

DOCUMENT NO: GATRS008.MEM

SUBJECT: Georgia Air National Guard Data Validation Reports - HAZWRAP Level C

Enclosed are the HAZWRAP - Level C data validation reports and the attached copies of data results forms (Form I's) which have data reviewer qualifiers added. Two data review reports are provided for the following types of analyses:

14 data packages for: Priority Pollutant Metals
Total Petroleum Hydrocarbons

If you have any questions concerning this submittal, please call (303) 987-2928.

cc: GANG - PF

C.C. JOHNSON & MALHOTRA, P.C.
215 UNION BOULEVARD, SUITE 215 • LAKEWOOD, COLORADO 80228 • (303) 987-2928

1979 Ten Years of Quality Service 1989

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GRAND RAPIDS

DOCUMENT NO.: GAIDS003.RVW

INORGANICS DATA REVIEW SUMMARY - HAZWRAP LEVEL C

Case No. N/A Project No. 27794.C0.02

Site Georgia Air National Guard

Contract Laboratory CH2M HILL - Montgomery* and Gainsville

Sample Delivery Group (SDG) See Below Sampling Date (Month/Year) 5/90, 6/90 & 9/90

Sample Matrix low level soils and waters

Type of Analyses/Special Request Priority pollutant metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, Zn)

Data Package #

16057*	16281	16864	16912	
16065*	16828	16873	16913	
16272	16834	16882	(see next page for	
16280	16853	16899	samples associated with	
			each data package)	

Data Reviewer Linda L. Morrison Date 1/31/91

QA Review by Jeralyn Guthrie Date 1/31/91

CCJM Approval by Richard Cheatham Date 1/31/91

Telephone logs/correspondence enclosed? Yes X No ____

Laboratory case narrative attached? Yes X No ____

Deliverable requirement violations found? Yes X No ____ Not Applicable ____

Note:
— The Level C Data Validation Guidelines as specified in HAZWRAP Requirements For Quality Control of Analytical Data, Section 6 (Document No. DOE/HWP-65/R1, Revision 1, July, 1990) have been used by the data reviewer as a basis for reviewing the data and applying flags, except as specifically noted in review comments.

— Please see data flagging definitions on the last page of this report.

(1/91 Revision)

To facilitate the review of this report, we are providing the following listing of samples associated with the respective SDG/Package Numbers.

16057

06-HA-02
06-HA-08
06-HA-09
06-HA-17
06-HA-BD

16065

05-HA-03
05-HA-08
Rinsate 5/25
Decon water 5/25

16272

05-SB-05-0-2
05-SB-05-6-8
05-SB-01-0-2
09-SB-01-6-8
09-SB-02-0-2
09-SB-02-4-6
09-SB-03-0-2
09-SB-03-4-6
09-SB-05-0-2
09-SB-05-6-8
09-SB-D2
05-SB-01-4-6
05-SB-01-7-8
05-SB-03-1-3
05-SB-03-9-11
05-SB-04-0-2
05-SB-04-8-10
05-SB-D-1

16280

01-SB-01-0-2
01-SB-01-12-14
11-SB-01-2-4
11-SB-01-8-10
11-SB-01-0-2
11-SB-02-10-12
11-SB-D3

16281

10-SB-01-0-2
10-SB-01-10-11
08-SB-01-0-2
08-SB-01-8-10
08-SB-02-0-2
08-SB-02-8-10
08-SB-D4
08-SB-03-0-2
08-SB-03-4-6
Rinsate Blank 6/29

16828

08-SW-01
08-SW-02
08-SW-03
08-SW-04
01-MW-02
05-MW-01
05-MW-02
05-MW-03
05-MW-04
Rinsate Blank 9/14

16834

05-EW-108
01-MW-01
06-MW-01
08-MW-01
08-MW-02
08-MW-03
08-MW-04
Rinsate Blank 9/17
08-MW-D1

16853

11-MW-01
11-MW-02
11-MW-03
11-EW-B3
10-MW-01
11-MW-D2

16913

09-MW-01

16864

09-MW-02
09-MW-03
09-MW-04
09-MW-05
09-MW-D3
Field Blank 9/20

16873

08-SS-01
08-SS-02
08-SS-03
08-SS-04
08-SS-05
08-SS-06
08-SS-D1
Rinsate Blank 9/21

16882

09-SS-01
09-SS-D2

16899

09-SW-01
09-SW-02
09-SW-D1
01-SW-01
01-SW-02
01-SW-03
01-SW-04
Rinsate Blank 9/25

16912

01-SS-01
01-SS-02
01-SS-03
01-SS-04
01-SS-05
01-SS-06
01-SS-07
01-SS-08
01-SS-09
01-SS-10
01-SS-11
01-SS-12
01-SS-D3

(1/91 Revision)

I. Deliverables

All data deliverables as specified for HAZWRAP Level C quality control were found in the package, and sent through resubmissions.

Yes __X__ No _____

Comments:

1. See the following Level C Data Deliverables Checklist for a listing of the Forms and data found in the package.

2. All Form 1's for water from the Gainsville Laboratory have values reported in units of mg/L rather than ug/L, thus the correct number of significant figures has not always been provided. The CLP system of flagging has not been used and a "<" sign rather than "U" has been used to denote undetected analytes.

LEVEL C DELIVERABLES COMPLETENESS CHECK LIST - INORGANICS

KEY

X	Included in package
O	Not included and/or not available
NR	Not applicable or not required
RS	Provided as resubmission

X	Sample results data sheets (Form 1 or spreadsheet)
	X/O CLP data flags used by laboratory
X	Initial calibration verification results (Form 2)
RS	Initial calibration curve data (not a specified deliverable)
X	Continuing calibration verification (Form 2)
X	Preparation blank results (Form 3)
X	ICP interference check sample (Form 4)
RS	Matrix spike results (Form 5a)
X	Post-digest spike sample recovery for ICP (if needed) (Form 5b)
X	Duplicate results (Form 6)
X	Blank spike/laboratory control sample (LCS) with each batch
	X Control charts developed by lab
X	Standard addition results (Form 8)
X	Holding times summary form (Form 10 or Form 13 and 14)

II. Holding Times

Samples were prepared and analyzed within holding times specified by the HAZWRAP data validation guidelines. Holding time is based on date sampled to date of preparation for analysis (with collection date not inclusive).

Yes __X__ No _____

Comments: No comment.

III. Calibration Quality Control

A. The required summary forms were provided and information was present to determine that initial calibration curves met guidelines (correlation, number of calibration standards, etc.) or method criteria.

Yes __X__ No _____

Comments: Data related to initial calibration curves was not initially provided and is not shown as a specific deliverable requirement for the laboratory. However, this information was provided by the laboratory upon request since data validation requirements specify review of this data.

B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standard analyses were reported as required and had recoveries reported to be within the CLP specified control limits.

Yes _____ No __X__

Comments: The following is a table of samples, analytes, recoveries and qualifiers associated with a non-compliant ICV or CCV standard:

Data package #	Analyte	Recovery	Qualifier
All sample results associated with 16912	antimony	111.8%	*

* All sample results for data package 16912 have been qualified R, rejected, due to low spike recoveries so no other qualifier is necessary.

IV. Blank Quality Control

A. A preparation/method blank was prepared and analyzed at the specified frequency.

Yes __X__ No ____

Comments:

No solid preparation/method blank materials were available for the Gainsville laboratory; however, associated aqueous blanks were prepared. No action is required by the data reviewer.

B. All analytes in the preparation blank were below the CRDL and thus compliant with SOW requirements.

Yes __X__ No ____

Comments: The solid preparation blanks for package 16065 had detection limits reported at a factor of 100 times the expected values. The laboratory was contacted and the corrected values were sent as a resubmission. No further action was taken by the data reviewer.

C. All analytes in the preparation blank were below the instrument detection limit.

Yes __X__ No ____

Comments: For packages 16057 and 16065 the laboratory has reported the detection limit for beryllium as 0.0 ug/L in the blank which is not entirely correct. The laboratory reported in a resubmission that their software does not report IDL's to 2 decimal places. No action is taken by the reviewer although it appears that the actual IDL is 0.04 ug/L.

D. The package contained other types of blanks submitted to the laboratory with the field samples.

Yes __X__ No _____ Not Identified _____

Comments: The following list shows the other types of blanks included in the package and contaminants found in these blanks. Data has not been qualified by the reviewer due to contaminants reported in these blanks due to the difficulty of determining specifically which samples and blanks are associated.

Package No.	Blank Type/ID	Analyte	Amount
16065	Rinsate 5/25	copper	7.1 B ug/L
		mercury	0.20 B ug/L
		zinc	33.9 ug/L
	Decon water 5/25	beryllium	0.14 B ug/L
		copper	20.2 B ug/L
		mercury	0.20 B ug/L
		zinc	44.0 ug/L
		lead	4.0 ug/L
16281	Rinsate Blank 6/29	None found	
16828	Rinsate Blank 9/14	None found	
16834	Rinsate Blank 9/17	None found	
16864	Field Blank 9/20	zinc	0.03 mg/L
		lead	0.003 mg/L
16873	Rinsate Blank 9/21	chromium	0.003 mg/L
		lead	0.003 mg/L
16899	Rinsate Blank 9/25	None found	

V. Accuracy Statements

A. Blank spike/laboratory control sample (LCS) analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within CLP matrix spike control limits.

Yes __X__ No _____

B. Laboratory control charts were provided in the package and the limits specified by the control charts were used for review.

Yes __X__ No _____

Comments:

1. The *following* blank spike/LCS analyses were reported to be outside laboratory control limits, however, the matrix spike recoveries for these analytes met all required limits so no qualifiers have been applied to sample results:

Analyte	% Recovery	Laboratory Control Limits %	Associated Data Packages
Silver	62.6	75 - 120	all soils samples 16065
Copper	80.0	91 - 103	all soils 16272
Zinc	80.0	89 - 106	all soils 16272
Cadmium	84.0	88.5 - 105.5	all soils 16281

C. The matrix (pre-digest) spike *frequency requirement* was met.

Yes __X__ No _____

Comments: The following samples were used for matrix spiking:

Data Packages	No. of Samples/Matrix	Sample Spiked
16057	5/soils	06-HA-02 (Hg only) 06-HA-02
16065	2/soils, 2/waters	06-HA-02 (Hg only) 06-HA-02
16272	18/soils	05-SB-05-6-8 09-SB-02-4-6
16280	7/soils	11-SB-01-2-4
16281	9/soils, 1/water	08-SB-01-0-2
16828	10/waters	05-MW-03
16834	9/waters	08-MW-D1 (furnace only) 06-MW-04 (flame only) 08-MW-04 (Hg only)

Data Packages	No. of Samples/Matrix	Sample Spiked
16853	6/waters	11-MW-02 (furnace only) 11-MW-02 (flame only) 11-EW-B3 (Hg only)
16864	6/waters	09-MW-D3 (Hg only) 09-MW-02
16873	7/soils, 1/water	08-SS-06
16882	2/soils	09-SS-D2
16899	8/waters	09-SW-D1 (furnace only) 09-SW-02 (flame only) 01-SW-01 (Hg only)
16912	13/soils	01-SS-12 (furnace only Hg) 01-SS-13 (flame only)
16913	1/water	09-MW-01

63 = soil samples	8 = soil spike samples	Frequency = 1 in 8
44 = water samples	5 = water spike samples	Frequency = 1 in 9

D. Matrix spike recoveries were within the specified control limits (75 - 125%).

Yes _____ No __X__

Comments:

1. The following matrix spike analytes were reported to be outside control limits:

Data Package	Analyte/Sample Matrix	% Recovery	Qualifier
16057	antimony/soil	57.5	UJ
16065	antimony/soil	57.5	UJ
16272	selenium/soil		
	*(both spike samples)	60	UJ,J
16828	antimony/water	20	R
	arsenic/water	30	UJ,J
	chromium/water	70	UJ,J
	lead/water	60	UJ,J
	selenium/water	0.0	R

(1/91 Revision)

Data Package	Analyte/Sample Matrix	% Recovery	Qualifier
16834	antimony/water	20	R
	selenium/water	0.0	J,R
	thallium/water	65	UJ
16853	antimony/water	35	UJ
	arsenic/water	35	UJ
	lead/water	65	UJ,J
	silver/water	63	UJ,J
	zinc/water	4.0	J,R
16864	antimony/water	0.0	R
	arsenic/water	50	UJ,J
	selenium/water	0.0	R
	thallium/water	0.0	R
16873	antimony/soil	60	UJ
	arsenic/soil	65	UJ,J
	selenium/soil	70	UJ
	thallium/soil	65	UJ
16882	arsenic/soil	135	J
16899	selenium/water	65	UJ
16912	antimony/soil	0.0	R
	arsenic/soil	0.0	J,R
	selenium/soil	40	UJ
	thallium/soil	35	UJ,J
16913	antimony/water	62	UJ
	arsenic/water	65	UJ
	chromium/water	143	J
	selenium/water	35	UJ

* Spike samples 11-SB-01-2-4 and 08-SB-01-0-2 both had a 60 percent recovery for selenium.

2. For data packages 16280 and 16281 only a post-digest spike was provided for selenium and arsenic. Soil results for these packages are qualified UJ due to the lack of pre-digest spike information.

VI. Additional Comments

1. The HAZWRAP data validation guidelines require the initial calibration data to be reviewed to ensure that the minimum number of standards were used, to evaluate the correlation coefficients and to ensure that the instrument was calibrated daily. This information was initially not provided and is not specifically a required deliverable for Level C; however, the laboratory did submit the needed information upon request.

2. The Gainsville laboratory did not initially report any of the pre-digest matrix spike recoveries that were outside the 75-125% limits; instead only the post-digestion spike results were reported. The laboratory was contacted and resubmitted the matrix spike recovery results Forms and reported the out-of-control matrix spike recoveries with the exception of selenium and arsenic as noted above for packages 16280 and 16281.

3. For those elements analyzed by graphite furnace, results for the analytical post-digestion spike recoveries were not provided. However, this information would be expected to be recorded only in the raw data and sample results do not require qualification based on analytical post digestion spike recoveries.

4. Duplicate analyses that exceeded control limits (from the Montgomery laboratory only) have been flagged by the laboratory as "*". The Hazwrap data validation guidelines do not require any qualifiers by the reviewer based on duplicate analyses.

EXPLANATION OF DATA FLAGS

For the purposes of this data review document the following code letters and associated definitions are provided:

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.

J - The associated numerical value is an estimated quantity because quality control criteria were not met.

R - Quality control indicates that data is not unable (ie. analyte may or may not be present). Resampling and re-analysis would be necessary to determine the presence or absence of the analyte in the sample.

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DOCUMENT NO.:GAIDS004.RVW

DATA REVIEW SUMMARY - HAZWRAP LEVEL C

Case No. N/A Project No. SEF27794.CO.02

Site Georgia Air National Guard

Contract Laboratory CH2M Hill - Montgomery

Sample Delivery Group (SDG) N/A Sampling Date (Month/Year) 5/90, 6/90, 9/90

Sample Matrix Low Level Soils and Waters

Type of Analyses/Special Request Total Petroleum Hydrocarbons

Data Package No:					
	16057	16281	16864	16912	
	16065	16828	16873	16913	
	16272	16834	16882		
	16280	16853	16899		

(See following pages for sample numbers found within each of these packages.)

Data Reviewer Linda L. Morrison Date 1/31/91

QA Review by Jeralyn Guthrie Date 1/31/91

CCJM Approval by Richard Cheatham Date 1/31/91

Telephone logs attached? Yes ____ No X

Deliverable violations found? Yes ____ No X Not Applicable ____

Data review complete based on additional required information received 1/22/91.

Note:

— The Level C Data Validation Guidelines as specified in HAZWRAP Requirements For Quality Control of Analytical Data, Section 6 (Document No. DOE/HWP-65/R1, Revision 1, July, 1990) have been used by the data reviewer as a basis for reviewing the data and applying flags, except as specifically noted in review comments.

— Please see data flagging definitions on the last page of this report.

C.C. JOHNSON & MALHOTRA, P.C.

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To facilitate the review of this report, we are providing the following listing of samples associated with the respective SDG/package Numbers.

 # 16057

06-HA-02
06-HA-08
06-HA-09
06-HA-17
06-HA-BD

 # 16065

05-HA-03
05-HA-08
Rinsate 5/25
Decon water 5/25

 # 16272

05-SB-05-0-2
05-SB-05-6-8
02-SB-01-0-2
02-SB-01-6-8
09-SB-01-0-2
09-SB-05-6-8
05-SB-01-4-6
05-SB-03-1-3
05-SB-04-0-2
05-SB-D1
09-SB-01-6-8
08-SB-02-0-2
09-SB-02-4-6
09-SB-03-0-2
09-SB-03-4-6
09-SB-05-0-2
09-SB-D2
05-SB-01-7-8
05-SB-03-9-11
05-SB-04-8-10

 # 16280

07-SB-02-0-2
07-SB-02-4-6
01-SB-01-0-2
01-SB-01-12-14
11-SB-01-2-4
11-SB-01-8-10
11-SB-02-0-2
11-SB-02-10-12
11-SB-D3

 # 16281

10-SB-01-0-2
10-SB-01-10-11
08-SB-01-0-2
08-SB-01-8-10
08-SB-02-0-2
08-SB-02-8-10
08-SB-D4
08-SB-03-0-2
08-SB-03-4-6
Field blank 6/29

 # 16828

08-SW-01
08-SW-02
08-SW-03
08-SW-04
01-MW-02
05-MW-01
05-MW-02
05-MW-03
05-MW-04
Field blank 9/13

 # 16834

05-EW-108
01-MW-01
02-MW-01
06-MW-01
07-MW-01
08-MW-01
08-MW-02
08-MW-03
08-MW-04
Field blank 9/17
08-MW-D1

 # 16853

11-MW-01
11-MW-02
11-MW-03
11-EW-B3
10-MW-01
02-SW-01
02-SW-02
11-MW-D2
Field blank 9/19

 # 16864

09-MW-02
09-MW-03
09-MW-04
09-MW-05
09-MW-D3
Field Blank 9/20

16873

08-SS-01
08-SS-02
08-SS-03
08-SS-04
08-SS-05
08-SS-06
08-SS-D1
Field blank 9/21

16912

01-SS-01
01-SS-02
01-SS-03
01-SS-04
01-SS-05
01-SS-06
01-SS-07
01-SS-08
01-SS-09
01-SS-10
01-SS-11
01-SS-12
01-SS-D3

16882

09-SS-01
07-SS-01
07-SS-02
07-SS-03
07-SS-04
09-SS-D2

16913

09-MW-01

16899

09-SW-01
09-SW-02
07-SW-01
07-SW-02
07-SW-03
09-SW-D1
07-SW-D2
01-SW-01
01-SW-02
01-SW-03
01-SW-04
Field blank 9/25

I. <u>Holding Times</u>

Samples were extracted and analyzed within holding times specified by the HAZWRAP data validation guidelines or method designated requirements.

Yes __X__ No _____

Comments: No comment.

II. <u>Instrument Calibration</u>

A. The instrument response or calibration factor data summaries were reviewed. The required summary forms were provided and information was present to determine that initial calibration curves met guidelines or method criteria.

Yes _____ No __X__

Comments: All correlation coefficients were greater than 0.995 and a 5-point calibration was performed daily for all except two water samples (Rinsate 5/25 and Decon water 5/25). The reviewer has qualified the results for these two samples based on the HAZWRAP Data Validation guidelines which require all results to be qualified "R", rejected, if a 3- to 5-point calibration is not performed daily. The HAZWRAP specifications for the laboratory and the method itself do not specifically state a requirement for a 5-point daily calibration. It was noted by the reviewer that a 5-point calibration was performed 3 days prior to the analysis of these samples and that continuing calibration checks were performed, but dates for these checks are not given.

B. The continuing calibration checks were summarized as required and review indicates that system stability was adequate and was verified at the required frequency.

Yes __X__ No _____

Comments: No comments.

III. Blanks

A. Method Blank - The blank analyses summaries were reviewed. The frequency of method blank preparation and analysis, and the contaminants reported in blank samples were all within specified limits (ie., less than the method detection limit).

Yes __X__ No _____

Comments: No comment.

B. Other Blanks - The following are other blanks found in the data package and the compound quantities reported, however no sample data has been qualified by the reviewer based on the results of these blanks.

Data Pkg #	Blank ID/Type	Analyte	Amount (mg/l)
16065	Rinsate 5/25	TPH	0.18
	Decon water 5/25	TPH	0.21
16281	Rinsate 6/29	TPH	not found
16828	Rinsate 9/14	TPH	not found
16834	Rinsate 9/17	TPH	0.08
16853	Rinsate 9/19	TPH	not found
16864	Rinsate 9/20	TPH	not found
16873	Rinsate 9/21	TPH	not found
16899	Rinsate 9/25	TPH	not found

IV. Blank Spike/Laboratory Control Sample(s)

A. Blank spike (or LCS) analyses were performed with each sample batch in the data package and were reported to be within laboratory control limits or within method control limits.

Yes __X__ No _____

B. Laboratory control charts were provided in the package and the limits specified by the control charts were used for review.

Yes __X__ No _____

Comments: For package 16272 the blank spike showed a recovery of 100.7% and based on the laboratory control chart this recovery is outside limits. At the time of these analyses 20 data points had not been used to establish the laboratory's control chart; therefore the data reviewer recommends that the 100.7% recovery be considered as acceptable, thus no data has been qualified.

VI. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

(MSD may not be applicable)

The matrix spike and matrix spike duplicate recovery summary data were reviewed. The spiking procedures were performed and met all recommended QC specifications.

Yes __X__ No _____

Comments: The following samples were used for MS/MSD analysis and are associated with the following data packages; please note the overall frequency of 1 per 20 was met, but not always provided within the individual data packages.

Data Package	Number of samples per matrix	Sample Spiked
16057	5 soils	06-HA-17(s)
16065	2 soils, 2 waters	06-HA-17(s)
16272	20 soils	05-SB-05-6-8(s) 09-SB-02-4-6(s)
16280	9 soils	11-SB-01-2-4(s)
16281	9 soils, 1 water	08-SB-01-0-2(s)
16828	10 waters	Chain of Custody states "No extra volume provided".
16834	11 waters	None provided
16853	9 waters	11-EW-B3(w)
16864	6 waters	09-MW-02(w)
16873	7 soils, 1 water	08-SS-06(s) (actual spike results & recoveries not provided)

Data Package	Number of samples per matrix	Sample Spiked
16882	6 soils	07-SS-04(s) (actual spike results & recoveries not provided)
16899	12 waters	07-SW-02(w)
16912	13 soils	01-SS-11(s)
16913	1 water	07-SW-02(w)

Total soil samples = 71, soil spikes performed = 9, frequency = 1 in 8.
Total water samples = 53, water spikes performed = 4, frequency of = 1 in 13.

VI. Additional Comments

1. The HAZWRAP guidelines require the data reviewer to verify that the minimum number of calibration standards were used, to evaluate the correlation coefficients and to ensure the instrument was calibrated daily. This information was not initially provided to the data reviewer and is not shown as a required deliverable from the laboratory. The calibration data was, however, provided by the laboratory upon request.

2. The HAZWRAP guidelines specify the need for review of duplicate analysis. However, the laboratory performed matrix spike duplicate analyses. The RPD's were reported for the duplicate spike recoveries and found to be less than 10% in all cases. The MSD matrix spike duplicate has been considered to suffice as the duplicate analysis since values were all within reasonable limits. Results are not qualified based on duplicate results.

VIII. Deliverables

All data deliverables as specified for HAZWRAP Level C quality control were found in the package.

Yes __X__ No _____

Comments: See the attached Level C Data Deliverables Checklist for a listing of the Forms and data found in the package.

LEVEL C DELIVERABLES COMPLETENESS CHECKLIST

KEY

X	Included in package
*	Form not included, raw data may provide necessary information
O	Not included and/or Not available
NA	Not applicable or Not required

X	Blank spike control sample(s) with each batch
X	Control chart developed by lab
X	Sample results - Form 1 or spreadsheet
NA	Sample chromatograms (if applicable)
X	CLP data flags used by laboratory
X	Holding Times (prep and analysis dates provided)
X	Surrogate Recoveries (if applicable)
X	Matrix spike/matrix spike duplicate (MS/MSD) or matrix spike alone and matrix duplicate (matrix spiking and duplicate analysis is to be 1 per 20 samples of similar matrix)
X	Method blank results summary
X	Initial calibration data summary
X	Continuing calibration data summary
NA	Second column confirmation - chromatograms (if applicable)

EXPLANATION OF DATA FLAGS

For the purposes of this data review document the following code letters and associated definitions are provided:

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated detection limit.

R - Quality Control indicates that data is not usable (i.e. compound may or may not be present). Resampling and re-analysis would be necessary to determine the presence or absence of the analyte in the sample.

J - The associated numerical value is an estimated quantity because quality control criteria were not met or because the amount detected is below the detection limits required by analytical Statement of Work. The laboratory uses this flag in the latter situation.

B - The laboratory uses this flag when the reported analyte was also found in the method blank. Data validation guidelines do not specify the use of this flag.

JN - Tentative identification of a compound at an estimated concentration. Resampling and re-analysis would be necessary for verification.

Appendix H
TOXICITY PROFILES

ARSENIC

Acute Toxicity Summary

Acute oral exposure can cause muscular cramps, facial swelling, cardiovascular reactions, severe gastrointestinal damage, and vascular collapse leading to death. Sensory loss and hematopoietic symptoms delayed after exposure to high concentrations are usually reversible. Inhalation exposures can cause severe irritation of nasal lining, larynx, and bronchi.

Chronic Toxicity Summary

Chronic oral or inhalation exposure can produce changes in skin, including hyperpigmentation and hyperkeratosis; peripheral neuropathy; liver injury; cardiovascular disorders; oral exposures associated with peripheral vascular disease; and blackfoot disease.

Cancer Potential

Known human carcinogen; oral exposures associated with skin cancer, inhalation exposures with lung cancer.

Other

Toxicity varies for different compounds; inorganic trivalent arsenic compounds usually more toxic than pentavalent compounds; high doses of some inorganic arsenic compounds to pregnant laboratory animals produced malformations in offspring.

BENZO[A]ANTHRACENE

Acute Toxicity Summary

No information is available on short-term dermal or inhalation effects.

Chronic Toxicity Summary

No information on systemic effects. PAHs as a group may cause skin disorders and immunosuppressive effects.

Cancer Potential

Evidence exists that benzo[a]anthracene is carcinogenic to laboratory animals through dermal and ingestion exposure routes. Inhalation data is not available. May cause skin and lung cancer. No reports relating cancer in humans from exposure to benzo[a]anthracene exclusively, but exposure from PAH mixtures.

Other

Mutagenic in laboratory experiments. Benzo[a]anthracene may be metabolized into reactive derivatives.

BENZO[A]PYRENE

Acute Toxicity Summary

Acute toxicity appears low when administered by oral or dermal routes to laboratory animals.

Chronic Toxicity Summary

Prolonged exposure may produce chronic dermatitis and reproductive changes. Repeated oral doses to mice have caused hypoplastic anemia. Induction of cancer is the key toxic endpoint from intermediate and long-term exposure.

Cancer Potential

Benzo[a]pyrene is a constituent of coal tar, which is classified as a Level 1 known carcinogen by IARC and a Level B2 probable carcinogen by the EPA. Ingestion may produce stomach tumors, and inhalation may produce lung cancer. Prolonged skin exposure has been linked to an increase in skin cancer among workers. Benzo[a]pyrene is considered to be the most potent carcinogenic PAH.

Other

Benzo[a]pyrene is a mutagen.

BENZO[B]FLUORANTHENE

Acute Toxicity Summary

No information is available.

Chronic Toxicity Summary

Systemic effects specific to benzo[b]fluoranthene have not been reported. Skin disorders and immunosuppressive effects have been reported for PAH mixtures.

Cancer Potential

Experimental evidence that it causes lung and skin cancer in laboratory animals by dermal absorption and intratracheal distillation.

Other

No evidence of reproductive or teratogenic effects.

BENZO[G,H,I]PERYLENE

Acute Toxicity Summary

Limited information is available.

Chronic Toxicity Summary

Limited information is available.

Cancer Potential

Liver and skin carcinogen in laboratory animals. Data available are inadequate to determine carcinogenic potential in humans. Has been reported to produce cocarcinogenic effects when applied to mouse skin along with benzo[a]pyrene.

BERYLLIUM

Acute Toxicity Summary

Acute lung disease (chemical pneumonitis) has been observed immediately after inhalation of aerosols of soluble beryllium compounds, such as beryllium fluoride and compounds (probably zinc beryllium silicate) in broken fluorescent light tubes. Several months after exposure the entire respiratory tract may become inflamed with fulminating pneumonitis in severe reactions. Recoveries usually occur within weeks, but fatalities have occurred. In studies with monkeys, high concentrations of aerosols of beryllium fluoride or beryllium phosphate produced severe lung reactions in all animals and damaged the liver and kidney as well as affecting adrenals, pancreas, thyroid, and spleen; many lesions were similar to those in patients who died of

pneumonitis. Conjunctivitis and contact dermatitis may follow exposure to beryllium, with skin lesions or ulcerations. Beryllium compounds may produce hypersensitivity with delayed allergic reactions.

Chronic Toxicity Summary

The lung is a major target organ for toxic effects of beryllium. Berylliosis, a chronic granulomatous lung disease that is frequently fatal, has been described for over 40 years among workers exposed to insoluble beryllium compounds; symptoms may include shortness of breath, cyanosis, clubbed fingers, lesions that progress to fibrotic tissue and nodules with respiratory dysfunction.

Cancer Potential

Beryllium compounds or alloys have produced cancer in rats, rabbits, and monkeys. Lung tumors have been reported in rats and monkeys exposed by inhalation, intratracheally, or intrabronchial implantation, and bone tumors have been produced in rabbits after intravenous or intraosseus administration. Excess lung cancer has been observed in some studies of workers occupationally exposed to beryllium, but data on exposure and confounding factors were lacking. Beryllium and its compounds have been classified by IARC as having sufficient evidence of being carcinogenic in animals and limited evidence in humans (group 2B) and by EPA as B1, probable human carcinogen.

Other

Wide variations in individual sensitivity have been reported, perhaps because of an immune reaction; individuals exposed to low doses may exhibit severe effects. Beryllium is stored in the body for many years with detectable amounts in lung reported as long as 23 years after exposure. Some beryllium compounds are mutagenic in vitro tests.

CADMIUM

Acute Toxicity Summary

For acute exposures by ingestion, symptoms of cadmium toxicity included nausea, vomiting, diarrhea, muscular cramps, salivation, spasms, drop in blood pressure, vertigo, loss of consciousness, and collapse. Acute renal failure, liver damage, and death may occur. Exposure by inhalation can cause irritation, coughing, labored respiration, vomiting, acute chemical pneumonitis, and pulmonary edema.

Chronic Toxicity Summary

Respiratory and renal toxicity are major effects in workers. Chronic oral exposures can produce kidney damage. Cadmium accumulates in kidney, and nephropathy results after critical concentration in kidney is reached, probably about 200 $\mu g/g$. Inhalation can cause chronic obstructive pulmonary disease, including bronchitis, progressive fibrosis, and emphysema. Chronic exposure affects calcium metabolism and can cause loss of calcium from bone, bone pain, osteomalacia, and osteoporosis. Chronic exposure may be associated with hypertension. Cadmium can produce testicular atrophy, sterility, and teratogenic effects in experimental animals.

Cancer Potential

Increased risk of prostate cancer and perhaps respiratory tract cancer in workers exposed by inhalation. No evidence of carcinogenicity from chronic oral exposure.

Other

A nonessential element.

CHROMIUM

Acute Toxicity Summary

Major acute effect from oral exposure is renal tubular necrosis. Inhalation of chromate salts results in irritation and inflammation of nasal mucosa, ulceration, and perforation of nasal septum.

Chronic Toxicity Summary

Chronic exposure to hexavalent chromium has resulted in kidney damage in animals and humans. Inhalation exposures to chromates in industrial settings have resulted in nasal membrane inflammation, chronic rhinitis, laryngitis, and pharyngitis. Exposures to skin can result in allergic skin reactions in sensitive individual. Overall, hexavalent forms are usually more toxic than trivalent forms.

Cancer Potential

Excess lung cancer has been associated with chromate-producing industry workers. Chromatic salts are carcinogenic in rats exposed by inhalation.

Other

Essential element. Toxicity is related to valence state.

CHRYSENE

Acute Toxicity Summary

Absorbed by oral and dermal doses.

Chronic Toxicity Summary

Chrysene accumulates in adipose and mammary tissues. Chronic toxic effects have not been described.

Cancer Potential

Carcinogenic in laboratory animals exposed to long-term dermal doses.

Other

Limited evidence that chrysene is mutagenic. Epidemiological reports incidences of skin cancer when exposed to PAH mixtures that included chrysene.

COPPER

Acute Toxicity Summary

Inhalation of copper dusts result in symptoms similar to metal fume fever. Exposure to metal fumes results in upper respiratory tract irritation, metallic or sweet taste, metal fume fever, and skin and hair discoloration. Exposure to dusts and mists of copper salt result in congestion of nasal mucous membranes, sometimes of pharynx, and occasional ulceration with perforation of nasal septum. Acute copper sulfate poisoning in humans (oral) sometimes fatal; includes vomiting, diarrhea, hypotension, coma, and jaundice.

Chronic Toxicity Summary

Hemolytic anemia after chronic exposure in some dialysis patients. Sensitive individuals with disorders of metabolism--Wilson's disease and Menke's disease.

Cancer Potential

Not indicated.

Other

Essential nutrient. Organoleptic threshold in water between 1 to 5 mg/l.

DIBENZO[A,H]ANTHRACENE

Acute Toxicity Summary

Oral absorption but has slow dermal absorption.

Chronic Toxicity Summary

Cancer Potential

IARC [1983] has concluded that there is sufficient evidence that dibenzo[a,h]anthracene is carcinogenic to laboratory animals. In laboratory experiments oral doses have caused tumors in mice, lung tumors in rats by intratracheal distillation and skin cancer following dermal application.

Other

High doses in laboratory animals have produced fetal deaths.

1,2-DICHLOROBENZENE

Acute Toxicity Summary

Acute exposure to 1,2-DCB is irritating to the eyes, skin, and mucous membranes. Liver damage has been observed in rats and mice after oral exposure to 250 mg/kg/day for 13 weeks. At 500 mg/kg/day, kidney damage and increased mortality were observed in the rats and mice.

Chronic Toxicity Summary

Animal studies of chronic exposure to 1,2-DCB have revealed liver pathology ranging from increased liver weights to necrosis at higher doses.

Cancer Potential

Evidence for carcinogenicity in humans or animals is inadequate for a determination regarding cancer potential. 1,2-DCB, however, is structurally similar to 1,4-dichlorobenzene, which is classified in EPA Weight-of-Evidence group C, possible human carcinogen.

Other

Teratogenic effects were observed in the offspring of rats exposed to 1,2-DCB by inhalation during pregnancy. Reproductive effects were observed in male rats after intraperitoneal injection of 1,2-DCB.

1,3-DICHLOROBENZENE

No information was located regarding the acute or chronic toxicity, or cancer potential of 1,3-DCB in humans or animals.

1,1-DICHLOROETHANE

Acute Toxicity Summary

CNS depression may occur when 1,1-dichloroethane is inhaled at high concentrations. Irritating to skin.

Chronic Toxicity Summary

Data limited.

Cancer Potential

Not indicated.

P-DICHLOROBENZENE

Acute Toxicity Summary

Skin lesions, irritation to eye and upper respiratory tract, vomiting, headache, anorexia, and anemia and blood dyscrasias reported in humans exposed to dichlorobenzene. Two cases of cataracts described. Tingling of hands, vertigo, weight loss in worker exposed to mixture containing p-dichlorobenzene.

Chronic Toxicity Summary

Hepatic effects have been observed in rats and mice administered p-chlorobenzene by gavage; these effects included cloudiness, swelling, necrosis, porphyria, and increased liver weight. Renal lesions have also been reported in rats and mice receiving p-dichlorobenzene by gavage; in some studies, multifocal degeneration and necrosis occurred. Effects on bone marrow, nasal turbinates, small intestine, spleen, and thymus have also been described in rodents. Changes in weight of spleen, liver, heart, kidney, and lungs were noted in rats exposed by inhalation, as well as liver and kidney lesions, pulmonary edema and congestion, and reversible changes in the eye.

Cancer Potential

In rats administered p-dichlorobenzene by gavage, renal adenocarcinomas developed in males; liver adenomas and carcinomas appeared in male and female mice. Classification as B2 or C considered by EPA.

Other

Lipophilic. In one study no fetotoxicity or teratogenicity in rabbits. Negative in most mutagenicity studies but abnormal mitotic diversion in higher plants.

1,1-DICHLOROETHENE (VINYLIDENE CHLORIDE)

Acute Toxicity Summary

Liver appears to be principal target. Biochemical changes and necrosis in liver in fasted rats have been reported to develop rapidly after inhalation. Liver damage in fasted rats can occur after one oral dose. At high concentrations, inhalation of 1,1-DCE can cause CNS depression in humans and unconsciousness.

Chronic Toxicity Summary

Described as "exquisite hepatotoxin" because it is more potent and faster acting than classic hepatotoxin, carbon tetrachloride. Kidney injury can also occur at relatively low doses. Reports of health effects on workers exposed to 1,1-DCE include liver function abormalties, headaches, vision problems, weakness, fatigue, and neurological sensory disturbances.

Cancer Potential

One group of investigators reported an increased incidence of kidney tumors in mice exposed by inhalation and possibly mammary tumors in rats. Tumor initiator activity

in mouse skin following several treatments with phorbol as promoter has been described.

Other

Structure similar to vinyl chloride, a known human carcinogen; mutagenic in bacterial tests; may be fetotoxic in laboratory animals.

ETHYLBENZENE

Acute Toxicity Summary

Ethylbenzene is irritating to eyes, mucous membranes, and skin. It can cause headaches and narcosis.

Chronic Toxicity Summary

Data limited.

Cancer Potential

Not indicated.

FLUORANTHENE

Acute Toxicity Summary

Toxic by oral and dermal absorption. Can cross epithelial membranes. A defatting agent that may affect the skin.

Chronic Toxicity Summary

Limited information available.

Cancer Potential

IARC [1983] concluded there is no evidence that fluoranthene is carcinogenic on the basis of available data.

When applied to laboratory animal skin simultaneously with other carcinogenic PAHs, has increased the carcinogenicity of the compound (i.e., cocarcinogenic effects).

FLUORENE

Acute Toxicity Summary

May be toxic by inhalation, ingestion, or dermal contact and absorption.

Chronic Toxicity Summary

Limited information available.

Cancer Potential

Data inadequate to determine carcinogenic effects [IARC 1983].

Other

No toxicity data are available for humans.

INDENO(1,2,3-CD)PYRENE

Acute Toxicity Summary

No information was located regarding the acute toxicity of IP in humans or animals.

Chronic Toxicity Summary

No information was located regarding the chronic toxicity of IP in humans or animals.

Cancer Potential

A carcinogenic response was observed in rats and mice after implantation or subcutaneous injection of IP.

LEAD

Acute Toxicity Summary

Acute inorganic lead intoxication in humans is characterized by encephalopathy, abdominal pain, hemolysis, liver damage, renal tubular necrosis, seizures, coma, and respiratory arrest.

Chronic Toxicity Summary

Chronic low levels of exposure to lead can affect the hematopoietic system, the nervous system, and the cardiovascular system. Lead inhibits several key enzymes involved in heme biosyntheses. One characteristic effect of chronic lead intoxication is anemia, by reduced hemoglobin production and shortened erythrocyte survival. In humans, lead exposure has resulted in nervous system injury including reduced hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. The developing child appears especially sensitive to lead-induced nervous system injury. Lead can also affect the immune system and produce gingival lead lines. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans. Exposure to lead is associated with sterility, abortion, neonatal mortality, and morbidity. Organolead compounds are neurotoxic.

Cancer Potential

Lead salts have some evidence of carcinogenicity in animals.

Other

Children are especially sensitive to low level effects.

MERCURY

Acute Toxicity Summary

Inhalation of mercury vapor can cause bronchitis and nervous system effects. Oral exposure can result in abdominal cramps, gastrointestinal effects, ulceration, shock, circulatory collapse, and renal failure.

Chronic Toxicity Summary

Occupational exposure to inorganic mercury can produce effects on nervous system, including tremors, erethism, muscular weakness, personality changes, gingivitis, and colored eye reflex. In children, pink disease has been reported after ingestion of mercurous compounds. Exposure to organic mercury can cause sensory and visual disturbances, tingling, paresthesia, numbness, tunnel vision leading to blindness, visual, peripheral neuropathy, weakness in extremities and progressive ataxia, tremor, cerebral atrophy, degeneration of nerves, and death.

Cancer Potential

Not indicated.

Other

Mercury is transferred transplacentally. Toxicity depends on chemical form. Metallic, organic, and inorganic compounds can be biotransformed.

1-METHYLNAPHTHALENE

Acute Toxicity Summary

1-MN is moderately toxic by ingestion based on an oral LD50 in rats of 1840 mg/kg. No other information was located regarding the acute or chronic toxicity, or cancer potential of 1-MN in humans or animals.

2-METHYLNAPHTHALENE

Acute Toxicity Summary

2-MN is moderately toxic by ingestion based on an oral LD50 in rats of 1630 mg/kg. No other information was located regarding the acute or chronic toxicity, or cancer potential of 2-MN in humans or animals.

NAPHTHALENE

Acute Toxicity Summary

Inhalation of vapor may cause eye irritation, headache, and confusion. Ingestion may cause abdominal pain, nausea, and vomiting. Skin or eye contact may lead to systemic effects such as bladder irritation, kidney effects, and nemoletic effects such as anemia and decreased hemoglobin. In animal studies, bronchial necrosis was observed in rats.

Chronic Toxicity Summary

Occurrence of cataracts upon naphthalene vapor and dust exposure has been observed in humans. Subchronic animal studies have shown that oral doses produced cataracts and degeneration of the retina. Dermatitis has been reported with repeated skin exposure. Two studies have reported hemolytic anemia in infants born to women exposed during pregnancy.

Cancer Potential

Studies have not shown that naphthalene is carcinogenic. Naphthalene is commonly found in coal tar and epidemiological studies have shown coal tar to be carcinogenic. The role of naphthalene alone could not be determined.

Other

Acute exposures to large doses may cause hemolytic effects (destruction of red blood cells). This effect is most pronounced in individuals with a hereditary deficiency of glucose-6-phosphate dehydrogenase.

NICKEL

Acute Toxicity Summary

Signs of acute nickel toxicity may include headaches, nausea, vomiting, chest pain, cough, hyperpnea, cyanosis, gastrointestinal and CNS effects, weakness, fever, pneumonia, respiratory failure, cerebral edema, and death. Acute exposures to nickel containing dust may result in chemical pneumonitis.

Chronic Toxicity Summary

Rhinitis, nasal sinusitis, and nasal mucosal injury are among the effects reported among workers chronically exposed to various nickel compounds. Allergic contact dermatitis and other dermatological effects are the most frequent effects of dermal exposure to nickel and nickel-containing compounds.

Cancer Potential

There is extensive epidemiological evidence indicating excess cancer of the lung and nasal cavity for workers exposed to certain nickel compounds. Nickel compounds implicated as having carcinogenic potential include insoluble dusts of nickel subsulfide and nickel oxides, vapor of nickel carbonyl and soluble sulfate, nickel carbonyl.

Other

May or may not be an essential element.

PHENANTHRENE

Acute Toxicity Summary

An irritant through inhalation and ingestion exposure. May also be dermally absorbed.

Chronic Toxicity Summary

May be an allergen.

Cancer Potential

Inadequate data for the evaluation in experimental animals.

Other

Can cause photosensitization of the skin.

PYRENE

Acute Toxicity Summary

Limited information is available.

Chronic Toxicity Summary

Limited information is available.

Cancer Potential

Evidence suggests that pyrene is cocarcinogenic in laboratory animal experiments.

SELENIUM

Acute Toxicity Summary

Acute exposures can produce CNS effects, including nervousness, drowsiness, and convulsions, and eye and nasal irritation.

Chronic Toxicity Summary

Chronic exposure to selenium-containing compounds by inhalation can result in pallor, coated tongue, gastrointestinal disorders, nervousness, garlic breath, liver and spleen damage, anemia, and mucosal irritation. Discoloration, decayed teeth, skin

eruptions, gastrointestinal distress, and loss of hair and nails have been reported in humans exposed orally. In livestock, excess intake can cause blind staggers--impaired vision, weak limbs, respiratory failure--and alkali disease--hair loss, sterility, atrophy of hooves, lameness, and anemia. Embryotoxic and teratogenic in animals.

Cancer Potential

Carcinogenic in laboratory animals. May be anticarcinogenic and protective in humans.

Other

Essential. Toxicity related to chemical form.

SILVER

Acute Toxicity Summary

Argyria (local or generalized impregnation of tissue causing discoloration of skin and eye) may affect eyes and respiratory tract. Gastrointestinal irritation may occur with oral exposure.

Chronic Toxicity Summary

Kidney and lung damage and possibly arteriosclerosis have been reported for industrial or medial exposures.

Cancer Potential

Not indicated.

TOLUENE

Acute Toxicity Summary

Humans exposed by inhalation experimentally, occupationally, or by intentional abuse may exhibit excitation, then CNS depression and nec sis. Neurotoxic effects include nausea, fatigue, and coordinat on at low levels and confusion, ataxia, and weakness at higher levels. In rats, irritation of mucous membranes and incoordination have been observed, as well as pulmonary irritation with subchronic exposure.

Chronic Toxicity Summary

CNS effects have been reported in workers, such as disturbances in memory and thinking, psychomotor skills, visual accuracy, sensorimotor speed, and performance tests. Indications of cerebral and cerebellar dysfunction include tremors, ataxia, and equilibrium disorders, bizarre behavior, and emotional lobility may occur. In cases of abuse, changes in liver and kidney function have been observed. In rats, a decrease in hematocrit has been reported.

Cancer Potential

Embryotoxicity and possible teratogenicity in mice have been reported in an abstract. In rats, skeletal retardation of offspring has been described.

Other

Not determined.

1,1,1-TRICHLOROETHANE

Acute Toxicity Summary

Trichloroethane is a CNS depressant and may impair psychophysiological functions. Human fatalities have been reported following deliberate inhalation or occupational exposures; lung congestion was found.

Chronic Toxicity Summary

Exposure by inhalation can produce liver damage in mice and affects drug metabolism in liver of rats.

Cancer Potential

Mutagenic in some in vitro tests.

Other

Not determined.

1,1,2-TRICHLOROETHANE

Acute Toxicity Summary

Severe irritation follows eye and skin contact. Inhalation can cause nose and lung irritation at low doses, and narcotic and anesthetic effects at higher doses. 1,1,2-TCA is a significant liver and kidney toxin. Acute exposure may also depress immune system function.

Chronic Toxicity Summary

Chronic exposure to 1,1,2-TCA may cause serious damage to the liver and kidney.

Cancer Potential

1,1,2-TCA is classified in EPA Weight-of-Evidence group C, possible human carcinogen, based on the development of hepatocellular carcinoma and pheochromocytoma after oral administration in one strain of mouse. 1,1,2-TCA is structurally similar to 1,2-Dichloroethane, a probable human carcinogen.

Other

1,1,2-TCA has caused adverse reproductive effects in male mice.

TRICHLOROETHENE (TCE)

Acute Toxicity Summary

Exposure to TCE can cause depression of the CNS, including dizziness, headaches, incoordination similar to that induced by alcohol, nausea, vomiting, and unconsciousness.

Chronic Toxicity Summary

Long-term inhalation exposure can affect liver and kidneys in animals. In humans, changes in liver enzymes have been associated with TCE exposure.

Cancer Potential

Exposure of mice (orally and by inhalation) and rats have produced increases in liver or lung or kidney tumors.

Other

"Degreasers flush" has been described in TCE-exposed workers who consume alcohol.

XYLENE

Acute Toxicity Summary

Acute exposures to inhaled xylene can depress the CNS and irritate mucous membranes.

Chronic Toxicity Summary

Changes in behavioral tests, manual coordination, balance, and EEG patterns have been reported in humans exposed to xylenes. Development of tolerance against some of these effects has been described. Effects on liver of rats have been reported.

Cancer Potential

Not indicated.

ZINC

Acute Toxicity Summary

Acute adverse effects of zinc include metal fume fever by the inhalation of fumes. Fever, nausea, vomiting, stomach cramps, diarrhea may result from acute ingestions.

Chronic Toxicity Summary

Prolonged ingestion of zinc can result in irritability, muscular stiffness and pain, loss of appetite, and nausea. High levels of zinc in diet may retard growth and produce defective mineralization of bone.

Cancer Potential

Not indicated.

Other

Essential nutrient. Taste threshold 15 ppm; 40 ppm soluble zinc salts impart a metallic taste.